Plates.—St. Luke's Hospital.

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THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.

85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

FEBRVARY MDCCCXCVI

NVMBER TWO

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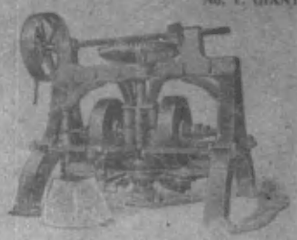

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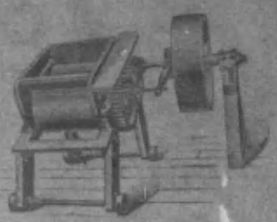

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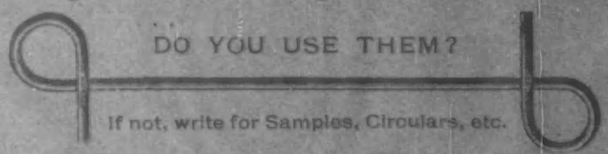

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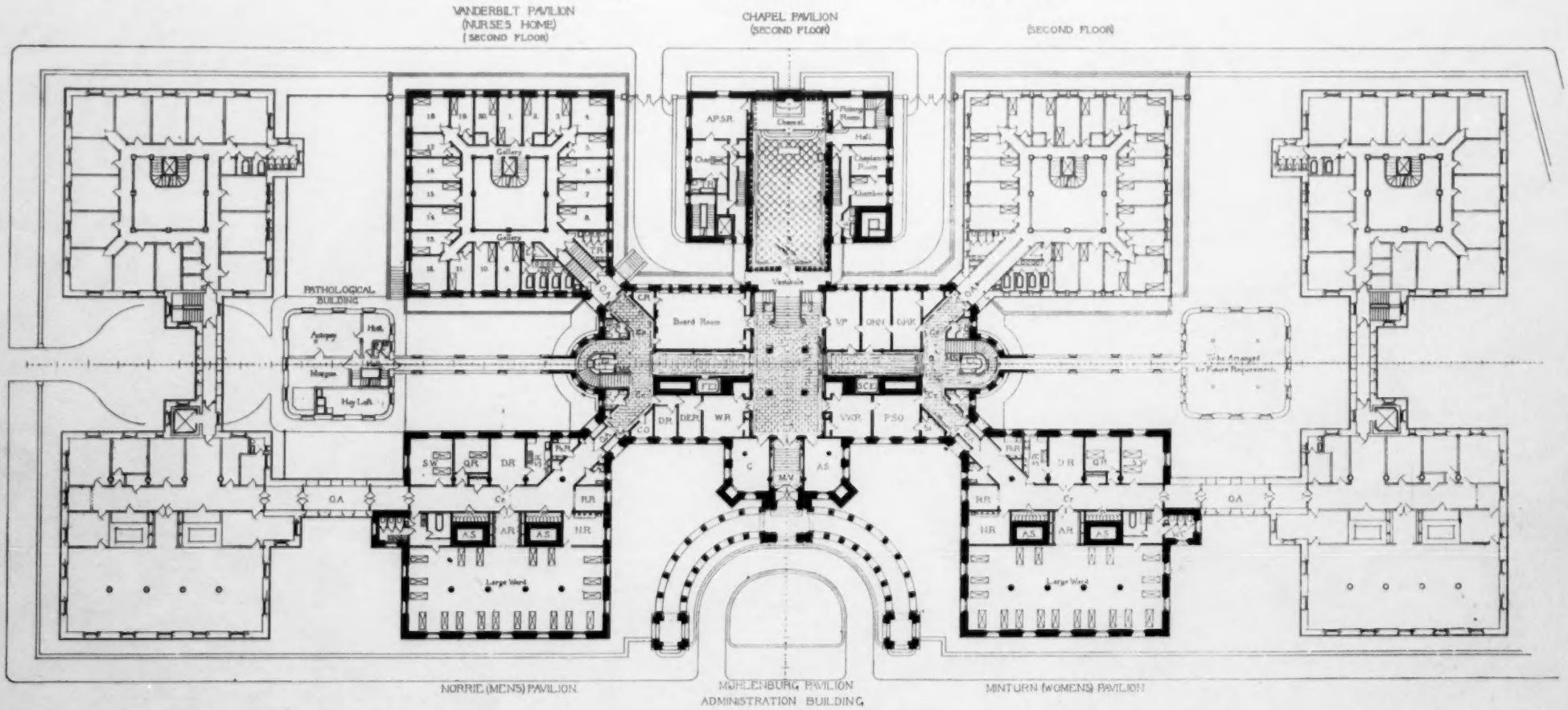


PLAN OF FIRST FLOOR.

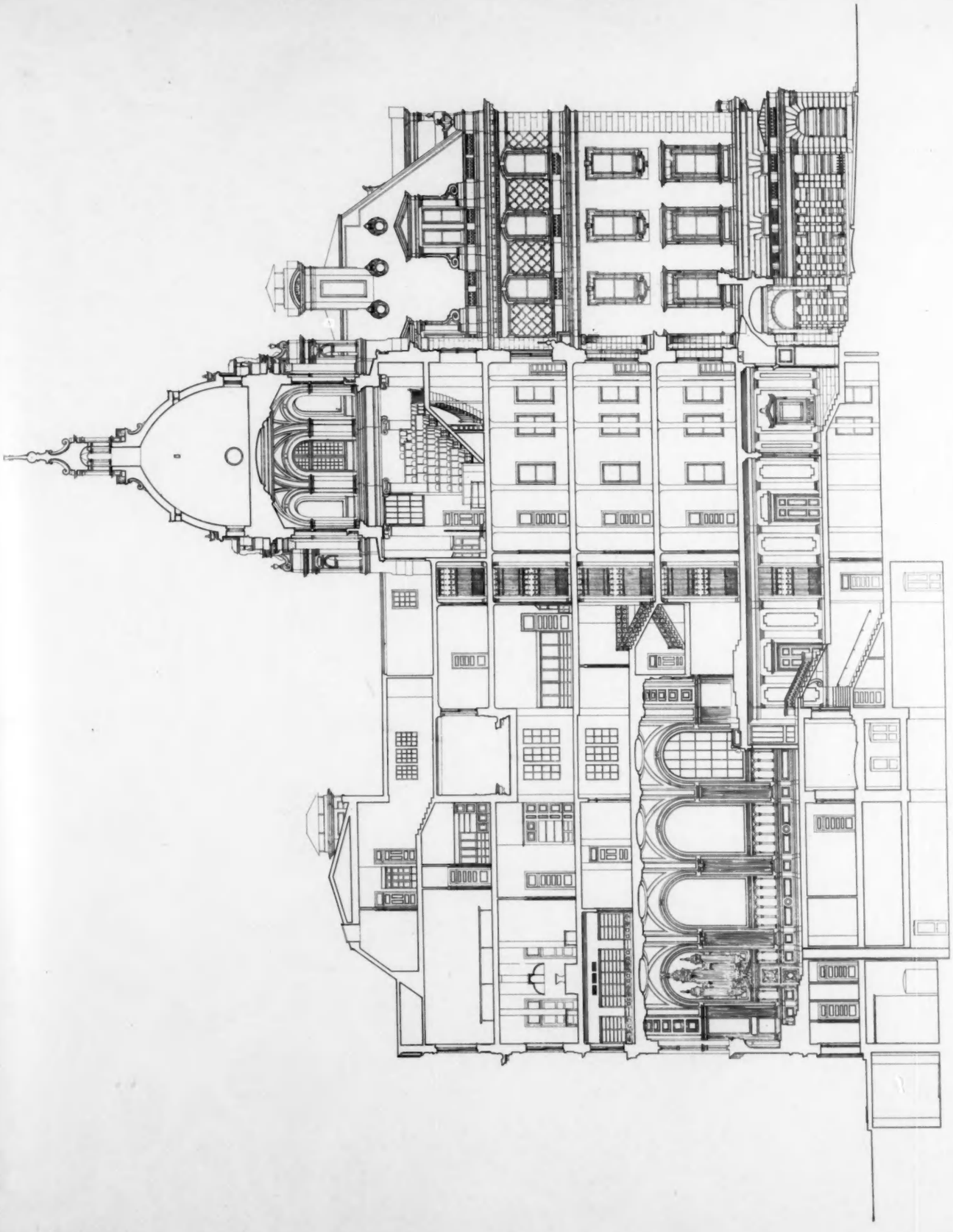
A. S. Air Shaft.
A. R. Ante Room.
A. P. S. R. Asst. Pastor and Superintendent's Room.
V. P. Visitors' Parlor.
Cr. Corridor.
C. Cashier.
M. V. Main Vestibule.
T. R. Toilet Room.
R. R. Reception Room.
V. W. R. Visitors' Waiting Room.
W. R. Waiting Room.
El. Elevator.
M. S. Main Stairs.
O. A. Open Arcade.
D. E. R. Doctors' Examining Room.
A. S. Asst. Superintendent.
L. C. Linen Closet.
P. C. Patients' Closet.
D. R. Dressing Room.
C. O. Chaplain's Office.
Hist. Histology.
P. S. O. Pastor and Superintendent's Office.
St. Stenographer.
C. R. Committee Room.
N. R. Nurses' Room.
O. H. N. Office for Head Nurse.
O. H. K. Office for Housekeeper.
Po. R. Poultice Room.

D.R. Dressing Room.

SAINT LUKE'S HOSPITAL, NEW YORK.
Elevation of East End.

SAINT LUKE'S HOSPITAL.
Front Elevation.
ERNEST FLAGG. Arch

HOSPITAL, NEW YORK.
Front Elevation.
ST FLAGG, ARCHITECT.

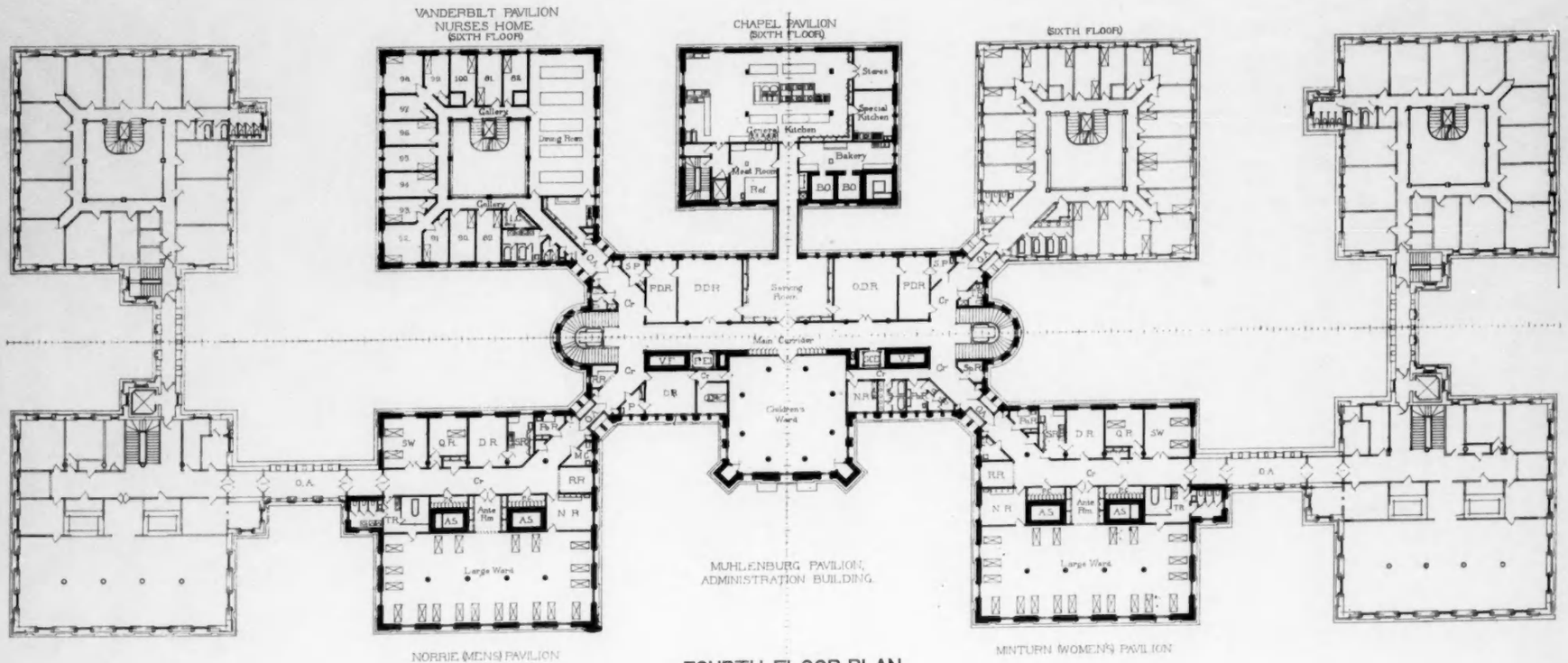


SAINT LUKE'S HOSPITAL, NEW YORK.

Sectional View.

SAINT LUKES HOSPITAL.

NEW YORK ERNEST FLAGG ARCHITECT



FOURTH FLOOR PLAN.

A. S. Air Shaft.
B. O. Baker's Oven.
R. R. Reception Room.
N. R. Nurses' Room.
D. R. Dining Room.
S. R. Serving Room.
Po. R. Poultice Room.
Q. R. Quiet Room.

M. C. Maids' Closet.
S. W. Small Ward.
Cr. Corridor.
Sp. R. Splint Room.
T. R. Toilet Room.
S. P. Special Pantry.
P. Pantry.
Lav. Lavatory.
O. A. Open Arcade.

L. C. Linen Closet.
D. D. R. Doctors' Dining Room.
O. D. R. Officers' Dining Room.
P. D. R. Private Dining Room.
S. C. El. Soiled Clothes Elevator.
F. El. Food Elevator.
V. F. Ventilation Flue.
P. C. Patients' Closet.

VOLVME V FEB. 1896 No. 2

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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WITH all the improvements which have been made in the mechanical details of the construction of terra-cotta, notwithstanding the ease with which we can secure evenness and uniformity of composition, we have not yet been able to excel, and indeed are hardly able to equal, the artistic qualities of the work which was produced in some of the art periods preceding the present day. Terra-cotta, as a building material, is all that we could wish it if properly manufactured. The tests which it is required to stand in first-class work are that the material shall be so hard it cannot be scratched with the point of a knife nor attacked by acid of a certain strength, and that its strength must be such that it will resist without crushing at least 6,000 lbs. to the square inch. These are very severe requirements, but can easily be lived up to in a mechanical sense. When it comes, however, to the more impalpable and less accurately measurable artistic qualities, there is something about the older work which seems to put it on a different plane from much of the terra-cotta we see in our modern buildings. There is a delicacy, a sense of refinement in detail, and a feeling of fitness in the employment of such work as is found in the Certosa cloisters at Pavia, or the tower of S. M. della Grazie at Milan, which is often conspicuously lacking in modern examples, even when the older forms are faithfully copied. We will not say it is always lacking, for there are some notable examples wherein the terra-cotta has been used in a manner which leaves very little to be desired; but, as a rule, we are inclined to think our designers have not struck quite the right spirit. A suggestion which appeared in a recent instalment of Professor Marquand's paper on the Della Robbia terra-cottas, published in the November number of this magazine, would seem to indicate a possible cause for at least a portion of the lack of fitness of which we complain. In describing the tomb of Bishop Benozzo Federighi, in the church of S. Francesco di Paola, attention is called to the polychromatic glazed terra-cotta frame, which is not painted and baked in large masses with ugly visible joints, but, like glass mosaics, is broken into small irregular pieces uniting to form a complete and solid whole. It is, in fact, a mosaic of glazed terra-cotta units.

If one will examine carefully and understandingly the terra-cotta work at the Certosa at Pavia, considering it simply as an art creation, the last thing that will occur to him will be any consideration of the joints, as such. A moment's reflection tells one that the pieces must be small, and that the joints are there, but they do not obtrude themselves, they are not cut right across a pattern, nor spaced so regularly as to emphasize themselves, but just as in the S. Francesco tomb, the terra-cotta forms a complete and solid whole, and is not an aggregate of small particles. In modern work it is very rarely that the same degree of attention is paid to the jointing. We are too apt to consider terra-cotta as a mere variety of brick, and to feel that somehow or other the joints will not be sufficiently prominent to manifest themselves, — that after the design has been elaborated on paper it can be ruled off arbitrarily into blocks of a convenient size for manufacture and handling without requiring any special consideration of the relation between the joints and the design. In brickwork we pay relatively little attention to the joints, and try to consider the wall surface as a whole, deriving texture from the proportioning and arranging of joints, but not influenced essentially in its character by the joints themselves. In terra-cotta, however, we must consider that we are dealing with mosaic work, and that the joints count for a great deal if they obtrude themselves. This does not mean that the joints must be made necessarily extremely fine, and surely it does not mean that the joints need be concealed or pointed and glazed in conformity with the general surface of the terra-cotta, but it does mean that when we are employing a material which, because of its essential nature, must be handled in blocks of certain or varying sizes, the shapes and the dimensions of these sizes must be considered in working out the design, if we are to produce a result which is coherent and self-contained. We imagine that much of the objection which exists in the minds of some architects against terra-cotta for the finest work has arisen from noting the result of injudicious jointing. Unfortunately, it seems to be assumed that architects do not know how practically to joint their own terra-cotta. The manufacturers apparently prefer to make such arbitrary divisions themselves without special reference to the design, so long as the construction is practical. The procedure ought to be in just the other direction. The architect should consider the terra-cotta as an aggregate of units, and should design his work with reference to joints just as truly as stained glass is designed with reference to the leads, or as block mosaic is designed in reference to the small tesseræ.

We believe the possibilities of terra-cotta are such as to permit of its application to any form or style of building, but terra-cotta must be always terra-cotta if it is to be truly successful. We cannot imitate wood, stone, or iron forms, and hope to get good results. We cannot expect the impossible from even this most varied material.

We are inclined to think that very little modern terra-cotta has

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been rightly designed in this respect. On the other hand, we believe that if the designers would make it a point to consider terra-cotta as a mosaic on a large scale, would pay more attention to the joints as a function of the design, or would make the design such as would conform to the possibilities of the material, and not expect that all joints be either vertical or horizontal, but rather so plan that the outline of the design and the outlines of the pieces in a measure coincide, there is no reason why the most delicate and graceful conceptions should not be so executed in terra-cotta that the joints, as details of construction, would be as inconspicuous as they are at the Certosa or in the Della Robbia groups, with a resulting effect which would be quite equal to the antique, and far more personal, so to speak, than would be possible with a less plastic medium. Stone is cold and intractable and must be hammered and chipped into life. Terra-cotta retains the very touch, the loving caress of the true artist workman, and only needs the proper assembling and judicious groupings of the constructive unit to make manifest its worth.

PLATE ILLUSTRATIONS.

SAINT LUKE'S HOSPITAL, PLATES 7, 8, 9, 10, 11, 12.

THE new St. Luke's Hospital, when completed, will consist of a group of twelve semi-detached buildings, standing on a high plateau to the northwest of Central Park. The plot is bounded on the east by Morningside Avenue, on the north by 114th Street, on the west by Amsterdam Avenue, and on the south by the Cathedral grounds. It is a superb location for a hospital, being very open and raised high above the general level of the city.

The arrangement of the buildings is an entirely new departure in hospital construction, it is an attempt to secure all the advantages of the pavilion system without the disadvantages of that system. The pavilion system in hospital construction came into vogue shortly after the Crimean War. The usual method is to separate the wards from each other by placing them in pavilions connected by covered ways, and to make them in the form of an oblong rectangle, having windows on each of the long sides, while the dependencies are placed at the two shorter sides; the patients' beds are between the windows (which latter are carried very high), so that the sick have a glare of light directly in their eyes all day long.

The main entrance to the building is in the base of the tower at the back of a courtyard on the south side. Beyond the entrance vestibule is the main hallway, some thirty odd feet wide, from which a broad flight of steps leads to the level of the chapel about 6 ft. up. The chapel is about 30 ft. wide, 70 ft. long, and 36 ft. high; the sides are divided into bays by pilasters, from the caps of which springs an elliptical barrel vault with penetrations. Almost the entire end is occupied by a great window with stone tracery; below it is the reredos of marble, at either side of which is a small arcade which is to be carried all around the sides. Between these columns are marble slabs bearing the names of the benefactors of the institution. The chapel is separated from the hall by a glass screen, so that a glimpse of the interior may be had immediately upon entering the building.

Midway between the chapel and vestibule a corridor extends in a longitudinal direction through the Administration Building, having the staircases at either end, near which other corridors branch off diagonally, leading to the surrounding buildings of the group.

One of the buildings on 114th Street is entirely devoted to the nurses. It has its own separate entrance, and the center is occupied by a glazed court, running through to the roof, having galleries at the floor levels, from which access may be had to the rooms. Each nurse has a separate room about 8 ft. wide by 16 ft. long, with a window to the outer air. At present, only one building for nurses has been erected, that to the west of the chapel; it is proposed to build a corresponding one of the same size to the east.

In the new St. Luke's the long connecting corridor is dispensed with, instead of which there is an open air cut-off between the various ward pavilions and the Administration Building; this open air cut-off is in the form of an arcade the full height of the story, through which runs a passage constructed of copper about 8 ft. high, and having at either side louvres to protect passers in inclement weather. By this arrangement there is no possibility of the circulation of air from one pavilion to another, and as the ward pavilions contain no staircases or shafts of any kind, it is impossible for air to circulate from one ward to another above or below it.

The wards themselves are lighted on three sides, the long side being towards the south; they are sufficiently separated from each other so that no sunlight is cut off, the sun enters by some of the windows in every ward during the entire day.

Each of the great wards is intended for twenty beds, all but four of which are arranged so that the direct light is shielded from the patients' eyes.

The dependencies of the wards occupy the north side of the ward pavilion, separated from the wards by a broad corridor, having windows at either end. The buildings which occupy the north side of the group are for the nurses, doctors, and administration purposes.

The buildings are of cream-colored brick with marble trimmings, all plain surfaces being of brick, and all molded surfaces of marble.

At the present time one half of the buildings are about completed, the remaining six are to be erected from time to time as the needs of the institution require them, and the funds are forthcoming.

ILLUSTRATED ADVERTISEMENTS.

ON page xxiv will be found the American Tract Society's twenty-one-story building, corner of Nassau and Spruce Streets, New York, reproduced from the architect's pen-and-ink perspective. The first five stories are granite, and the remaining sixteen are terra-cotta of the same sober gray tint, with bricks to match, the latter being relieved by bands of a somewhat lighter shade. As will no doubt be remembered by many of our readers, attention was directed to this building in an article published in THE BRICKBUILDER, for May, 1895, entitled "Terra-cotta or Stone?"

The four allegorical figures by which the angles of the twenty-first story are emphasized measure about 18 ft. in height, and were

modeled at the New York Architectural Terra-Cotta Company's Works, by Mr. Miranda. The roof, covered with tiles of a dark chocolate, makes an effective sky line, and considering its great height, the contrast, though bold, is not too strong. When we say that Mr. R. H. Robertson was the architect, it will be readily understood that there is nothing tame or commonplace about the building. The adjoining print is from a photograph of the upper stories, taken from the roof of the Potter Building, 38 Park Row.

The design shown in the advertisement of this company is by Edwin R. Clark, Lowell, Mass., and is the one that took second prize in the competition which was recently held through the columns of THE BRICKBUILDER.

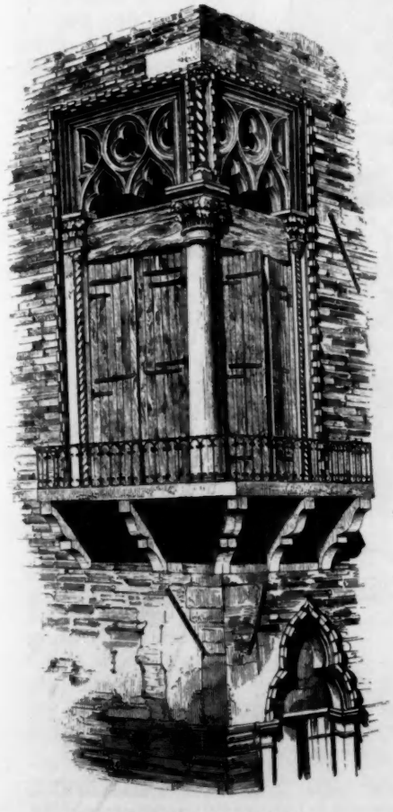
BRICK AND MARBLE IN THE MIDDLE AGES.

G. EDMUND STREET.

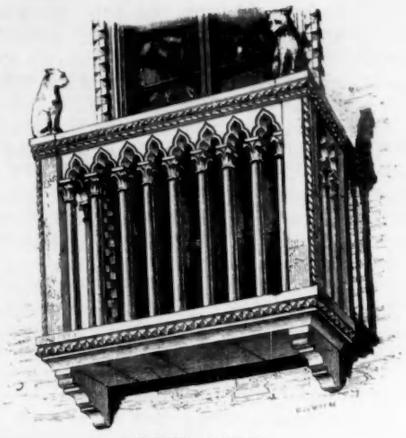
CHAPTER VIII.— *Continued.*

ANOTHER palace, also said to belong to one of the Badoer family, placed at the junction of two canals very near the Scuola di San Giorgio and the Greek Church, is remarkable as being now one of the very few houses in which the red brick walls are still in their original state, and not defiled by compo, paint, or whitewash. This house has three fronts, with one old doorway on the canal, and two on the land. The back, facing the Campo San Severo, has an unusually fine and lofty entrance, a square doorway with a pointed arch above (which I suppose once held tracery), and a group of five windows with circles or disks of marble in their spandrels above. Amongst other things, it is remarkable as an instance of the way in which windows were sometimes placed absolutely at the very angles of the building. Judging by the similarity of its tracery to that above the Porta della Carta in the Ducal Palace, this angle-window must date from about 1400 to 1430. It has a very bold shaft at the angle, whilst the jambs have pilasters ornamented at their angles by a twisted cord-like molding, which is frequently met with in the later work. There is a small angle-shaft elaborately twisted just above this window, and very much like the angle-shafts of the Ducal Palace.

The composition of the main window in the front of this house is, I think, very striking. The lower window of four lights (one of which is larger and loftier than the others — a curious instance of the junction of regularity with irregularity), and whose arches are ogee trefoils, is surmounted by another window of four lights, with delicate balustrading between the shafts; and on each side of this upper window, and forming part of the composition, is a single light, with projecting balcony. The effect of the whole arrangement is pleasing, and is frequently repeated in other palaces. The marble incrustation over this window is very much like that in the other Palazzo Badoer; and from the center of the medallions of marble small balls of marble project, fixed with metal, and giving great life and beauty to the medallions, and I think without any sacrifice of truth. The main fabric of this building must be of the latter part of the fourteenth century — the arches of the principal window being of a very excellent though simple type. Venetian balconies, of which this palace affords such good examples, are very beautiful and very characteristic. Nowhere else are they seen in such perfection; nowhere else, perhaps, were they ever so absolutely necessary. The palaces rose out of the dark water which washed against their foundations, and no ground could be given up for shady arcades as in other Italian cities, nor were there any paths to be strolled along; the only resource was, therefore, to gain from the air that which the land could not afford, and by projections in front of the windows, to obtain that power of enjoying the delicious evening atmosphere, so cool and pleasant after the fatigues of the too sultry day. These balconies are almost always very similar, consisting of a number of delicate shafts with carved capitals, supporting a piece of stone whose under side is notched up in a series of trefoils (generally ogee), resting upon the capitals of the shafts. These are divided occasionally by pilasters, under which are corbels jutting out boldly to support their weight; and above which sit, generally, quietly, and placidly eyeing the gondolas as they shoot silently by, small lions, dogs, or other animals — a quaint finish which one soon learns to like; their angles are often marked by corded moldings, and the edges of their floors and copings are almost always molded and specked with the perpetual notchings of the nail-head, and their under sides or soffeits are frequently carved or paneled.



ANGLE WINDOW, VENICE.



BALCONY, VENICE.

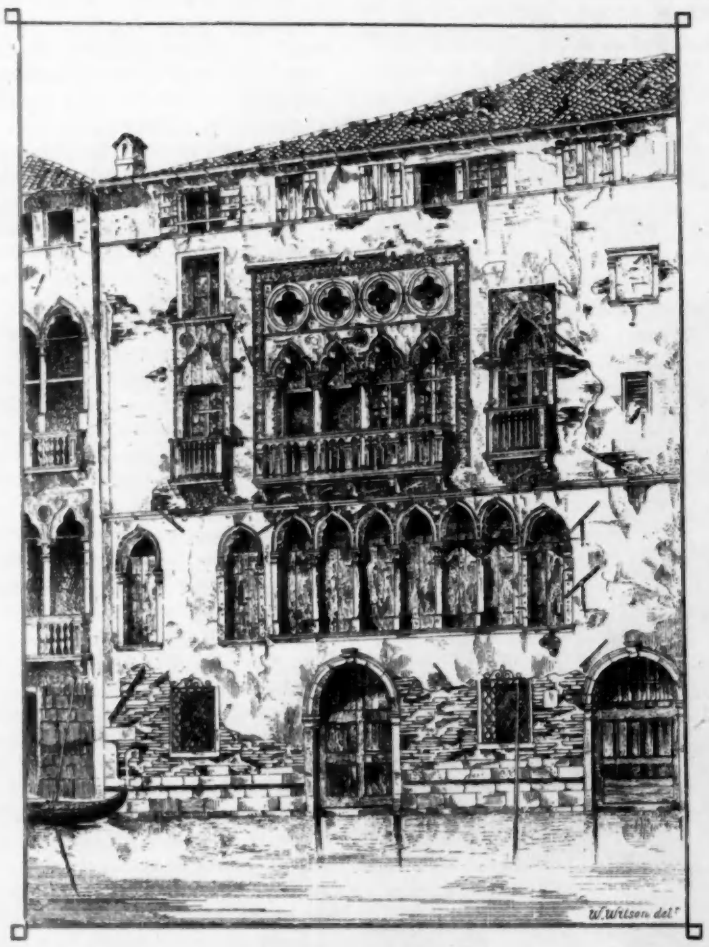
There was great variety in the planning of these balconies. In the Palazzo Persico, for instance, in which the central windows of the second and third stages form one great panel, the lower balcony is continuous across all four lights of the window, whilst the outer lights only of the upper window have balconies, the two middle lights having instead a balustrade between their shafts. In other cases the balconies extend to four lights only of a six-light window, whilst in most they are confined to the central windows, to which they give much additional dignity. The Ca' Fasan affords an almost solitary example[1] of tracery in a balcony; and the effect of this is so vastly inferior to the usual shafted balconies, that it seems scarcely necessary to pause to consider why it should be so. Obviously, however, it is not very convenient to have the fretful points of cusps and traceries set, as it were, to catch every projection or point of your dress whenever you lean over the edge of the balcony to inhale the fresh air or scan the busy scene below.

In the Casa Persico, to which reference has already been made, the central window is an elaborate composition of the same kind, but the lower one is of more importance, and has a continuous balcony;

[1] There is another traceried balcony in the canal near the Bridge of Sighs. It is the only other example I know in Venice.

and here I may notice the finials with which the ogee arches of Venetian windows are so often finished. They appeared to me to be invariably tasteless and poor in execution, and very mean in their outline. I did not see one finial in Venice which was satisfying, even when found in conjunction with otherwise fine work, and I used to wish heartily, when I reached some palace not before seen, that I might find its arches finished without them. There was some reason for the wish, too, in the fact that it is in the latter work that these tasteless ornaments are commonest. I saw them first at Verona and lamented over them there, but at Venice I was positively annoyed by the persevering and endless thrusting of their poverty and badness upon my wearied eyes.

And now let us go again into the Grand Canal, and we shall not have gone very far up the broad water above the Rialto before we shall find, on our right hand, one of the most striking groups of medieval palaces and houses which can be seen anywhere, even in Venice; this is where the famous Ca' d'Oro unites with some three or four other houses, of rather earlier date, and gives a very fair idea of what the water scenery of the ancient city once was. There is some difficulty in criticizing the Ca' d'Oro, because, in the first place, it has been restored to render it fit for the occupation of Mdlle. Taglioni; and, in the next place, much of the elaborate decoration from which it derived its name has perished or been destroyed. As it is, however, it is still a very sumptuous example of the later fourteenth-century Gothic. Its whole face is inlaid with squares of red and white marble, and a great amount of carving is spread over the entire surface, round and between the windows. This is very flat, but good in its effect. The arcade on the water story, and the traceried arcades above, all open into recessed courts,—an arrangement peculiar, I think, among Gothic houses, and similar in its purpose to the arcades in the Byzantine palaces. Some of the balconies are good, and the carving of the capitals and molding of the window traceries are very characteristic of Venetian pointed. The whole design is one-sided, and gives the impression of a house to which an additional wing has been added. The water stage consists of an open arcade of five arches, the central arch round, the remainder pointed, and on one side of these are two windows with a continuous balcony. The second and third stages have, above the five open arches, elaborately traceried windows, of no less than eight lights in width, filling almost the entire front, the outside lights having balconies, whilst the others have balustrading. Over the two windows of the water stage are single-light windows in each stage. There are throughout this front many medallions of dark marble, which, let into a field of light marble, are most brilliant in their effect.



PALAZZO SEGREDO, VENICE.

The most remarkable features in the Ca' d'Oro are, however, the triple and elaborately carved and chevroned angle-shafts which I have nowhere else seen,[1] and the very singular parapet. The height of this is greater about the center and at the two ends than elsewhere; but this appears to have been done rather with the intention of carrying up to the very top the noticeable division in the building itself than for any other reason. A very small portion only of the parapet is perfect, and this it is rather difficult to get at. The small balls of marble affixed to the outer edge of the trefoils are like those in the tracery of the Ducal Palace, and in the center of the medallions of marble everywhere throughout the city. Their effect is certainly very piquant.

CAPITAL OF WINDOW-SHAFT, VENICE.

By the side of the Ca' d'Oro there are three ancient houses of considerable interest, and the second from the Ca' d'Oro, the Palazzo Segredo, was a very good example, indeed; it has, unhappily, I believe, all been restored and painted, so that now few would believe that it could ever have been (as it was) one of the very best works in Venice of its age. It quite deserves illustration on account of the extreme vigor and beauty of its great window, which has more of the flavor of the arcade in the Doge's Palace than anything else in Venice. These three houses are all more than usually irregular in the arrangement of their windows.

Lower down the Grand Canal, and nearly opposite the post-office, is the Palazzo Pisani-Moretta, a very late building, in which all the balconies are Renaissance, with ordinary balustrading; but this occurs so often in connection with the latest examples of Gothic work, that I am disposed to believe that they were possibly, after all, contemporary in their erection. This palace, too, is remarkable for its double entrance doors, with ogee arches, and for the manner in which the central window is carried up in an uninterrupted way to the very cornice; the lower traceries being very fair, those in the upper story very weak and bad.

The Palazzo Falcanon (alla Riva Tonda) is another fine house. It has two water gates, is four stories in height, the third being the principal floor. The angle-shafts are all spiral, and the string-courses all ornamented with cable moldings, which, as is usual, are twisted in reverse ways from the center of the front.

[1] They may be compared with the chevroned and spiral columns in the archway leading from the north aisle into the baptistery of the Frari, erected between 1361 and 1396, which is probably about the date of the Ca' d'Oro.

The Palazzo Celsi, near the Frari, is, like the Badoer Palace, an example of a fine regularly designed house with its brickwork left in its natural state; and the Palazzo Orfei is an instance of the finest (and a very fine) front being turned towards a *campo* and not towards a canal. The long group of medieval houses, which formed one side of the Campo Sta. Maria Formosa, was equally worthy of admiration, but has lately been modernized, — a fate which is only too rapidly overtaking most of what one used to admire in this once fortunately neglected city!

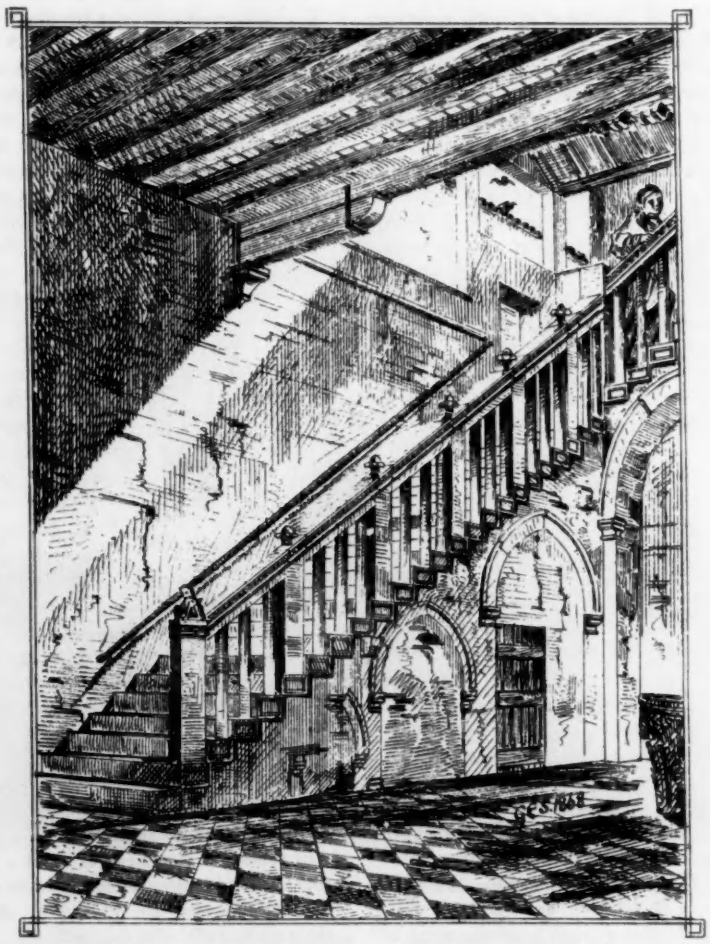
The window of which I give an illustration, on the Ponte del Fornaro, is a rare but extremely good example of the combination of sculpture and tracery. Here the carvings are good examples of the emblems of the four Evangelists very ingeniously treated, and the whole window has more force than most of the traceried windows.

With notices of two more buildings, the Palazzi Cavalli and Barbaro, I shall conclude my remarks upon the existing examples of Venetian domestic work. Neither of them calls for much remark. The traceries of the Cavalli Palace are heavy and unsatisfactory, and contrast unfavorably with the greater simplicity of the windows in the Palazzo Barbaro. The two palaces stand, however, in a very fine position on the Grand Canal, commanding the view from the Foscari Palace in one direction to the church of the Salute and the mouth of the canal in the other. Nearly opposite them is a very striking house, the Ca' Dario, built, I imagine, about the commencement of the sixteenth century, before the revived classic feeling had fully possessed the Venetians, and displaying some effective and beautiful arrangements of constructional decoration with colored marbles. It is, in fact, an attempt to revive, to some extent, the art of incrustation, as practised at S. Mark's, and so successful is it, that I wonder much that more examples are not met with.

In the Grand Canal, and near this spot, are many other buildings, all worthy of illustration, but adding, I think, nothing to what we already know. The Ca' Fasan is the most unlike the other medieval houses of any; but it pleased me so little that I could not bring myself to waste time by sketching it. It is only fair to say that in its traceried balconies it approaches more nearly to the latest northern pointed than any other building in Venice, and that it has perhaps at the same time less breadth and dignity than any.

Two fine palaces[1] are now turned into hotels, and that at which I stopped was full of remains of pointed windows; indeed, traces of pointed work are singularly plentiful, and I might go on to an interminable length were I to attempt to describe them all. The Arsenal is old, I believe, but has been modernized. It may be visited now for the sake of the grand and quaint old lions which sit before its entrance.

[1] The Europa Danieli's.



CASA GOLDONI, VENICE.

Of the interiors of these houses I cannot say very much. They usually have a great hall in the center of each floor, into which the various rooms open; and the windows of these halls are generally the most important in the elevation. The frames of the windows were of wood, placed behind the traceries, and the original ceilings were the molded beams of the floors. I have only seen one good Gothic staircase in Venice. This is in the Casa Goldoni, and has for its balustrade a series of shafts with piers at intervals. Its detail, in short, is that of the balcony, but sloped up to suit the rise of the steps. Pointed arches of brick carry the steps. This house may well be visited by other than architectural pilgrims, and will be found near the Ponte San Tomà. A fine early Renaissance staircase remains in the Palazzo Minelli, near San Paterniano. This is circular, with continuous open arcades following the rise of the steps, the usual shafted balustrade filling the lower part of the openings between the columns. The chimneys of these palaces are very singular. Not many old examples remain, but they are still copied, and that some of them are really old is proved by the extent to which they are shown in early Venetian paintings, as, *e. g.*, in the works of Gentile Bellini and Carpaccio. In my illustration the examples Figs. 2 and 3 are copied from paintings, and Fig. 1 is from a palace near the Ponte Bernardo.

And now that we have so far passed in review a series of the finest remains of medieval architecture in Venice, it is time to inquire how much is to be learned by what we have seen, and in what degree it differs from the developments of pointed architecture with which we are familiar in Northern Europe.

I think the very first point to be observed is, that in Venice architecture was never essentially constructional in the sense in which it was in our own land. The pointed arch is rarely used except in churches, and in its place traceries, increased in size and scale to do their work, are made to carry the entire weight of walling above them, as is the case, to take the foremost example, in the second stage of the Ducal Palace. And it is remarkable that when the arch was used, from a very early date it was the ogee arch, and not the arch formed by two simple curves; indeed it may almost be said that the pure pointed arch was never used, save where it would have been quite impossible with any other contrivance to bridge the necessary gap, or provide sufficiently for the weight to be supported. How striking a contrast this is to the way in which in England men worked with and exhibited the pointed arch, evidently as if and because they loved it! — using it not only as a sturdy servant to do heavy work, but as the friend of whose friendship they were ever the most anxious to boast. I do not complain of the flatness and lack of breaks or recesses in the masses of the great Venetian buildings, because this no doubt arose in part from the value of every foot of

ground so hardly gathered from the sea, and the difficulty of throwing out buttresses into the narrow depths of the canals out of which they rise. And the same conditions which enforced this flatness are grateful because they involved the charming balconies which are so peculiarly Venetian, and gave a breadth and simplicity to the outline which has its own artistic charm.

In the science of molding I cannot but think that it is quite useless to compare works executed for the sunny skies of Venice with those fitted for the gloomy sunlessness of a northern climate. The one kind are as properly soft, gentle in their alternations of light and shade, and delicate as the other are piquant and sharp, rejoicing in the dark shade of deep hollows and endless intricacy of outline and arrangement. But I feel no doubt whatever that, unfair as it may be to compare one school with the other, seeing that each worked for its own wants, it is yet most clear that the northern architects were developing a much deeper art, and working with much more consummate skill than were the Venetian. The endless variety of the arrangement of capitals, and the necessary grouping of moldings to fit their varying outlines, was carried to the extreme point of perfection by the one school, whilst in the other, not only was there much less depth and relief, but also very much less variety. The abacus of the Italian capital was almost always square in plan, and, as an almost necessary consequence of this, moldings retained very much the same arrangement and shape for the whole period of the prevalence of the pointed style, and generally rather leaned to the side of heaviness than of delicacy. Venetian moldings are composed of the constant combination of a three-quarter bead and a shallow hollow divided by small fillets, and so invariably arranged in almost exactly the same order, that it requires very great care to decide upon the date of buildings by their moldings with any sort of approach to certainty.

In addition to simple moldings, there are also the ever-recurring ornamented moldings which are so peculiarly characteristic of Venetian works of all dates. These consist generally of sections which in England we should consider Romanesque, but which in Venice appear to be much more common in the latest works than in the earliest. Chevrons, cable-moldings, billets, and the like are seen everywhere, and suggest the question whether this class of ornamented moldings, so largely used in the early days of architecture in England and so little afterwards, might not with some advantage be rescued from the contempt into which it has fallen with modern builders. They have the advantage of being within the power of any ordinary workman to execute, and do not, therefore, require the handiwork, which is so rare and so precious, of thoroughly good carvers. Add to this that some features, originally invented for use in the way of holding together marble incrustations, were afterwards used universally for their own sakes as ornamental moldings, for which office they were in no way fitted, and I think nearly as much has been said as can be of Venetian moldings in stone. Those in brick are even less satisfactory, but they occur mainly about the churches, and, as I do not recognize anything at all distinctively Venetian in their design or arrangement, it will be better to say more about them after we have seen the brickwork in other cities in the north of Italy, compared with which that at Venice is not of the first order.

In the practise of carving, as in that of molding, I see no reason for yielding the palm to the Venetian. It is true, indeed, that the Byzantine capitals — of which such magnificent examples exist at S. Mark's — are some of the most exquisite I have ever seen, true and precise in their sculpture, reveling in the utmost delicacy of intricate work, and always refined and elaborated with great evidence of care and thoughtfulness; but after the earliest school, and those later examples in which they were copied and regarded as models, there appears to me to be much less to admire. There is a confusion and want of fixed purpose about many of those which are commonly referred to as the best types of Gothic sculpture, which is at best not satisfactory, and I confess that I came away much more pleased with some of the Byzantine capitals than with any others. They have some notable points of difference from those to which we are used. They are generally much larger in proportion to the shaft than ours; and instead of having a regular neck-molding, they rise out of the shaft with a kind of swell, which, as being less definite, is to me less satisfactory than our neck-molding. The capitals of all dates are very generally similar in their outlines; this in part arising from the constant occurrence of circular columns with capitals, whose abaci are square, and in part from the imitation, more or less closely, of Byzantine models. Indeed, it is impossible not to see how great an influence the earliest remaining work — that of the eleventh century — had in Venice until the end of the fourteenth and far into the fifteenth century. The most beautiful and striking arrangements of the former age are reproduced and only slightly modified in the finest work of the latter to a very remarkable extent, and so much more decidedly and frequently than are the traces, in northern pointed, of any hankering after the features of Romanesque buildings, that I think but one conclusion can fairly be drawn from the sculpture of Venice as well as from its architecture, viz., that pointed architecture was never developed as purely and thoroughly in Venice as in the north of Europe, and that, though it retained its sway there nearly as long as it did elsewhere, it never thoroughly understood or felt its own strength, and worked and toiled tied down and encumbered by Byzantine fetters and classic sympathies. There is much, notwithstanding this, to admire, and, above all else, the greatest beauty of the style, wherein it so far left us behind, the thorough appreciation and unsparing use of the shaft. It is quite astonishing how very little this was ever used in England. Occasionally, indeed, it was freely used in grand buildings, and in some individual features it was frequently seen in thirteenth-century buildings; but, at the very period when, if ever, architecture was in its perfection — in the early part of the fourteenth century — it was almost entirely forgotten and thrown aside. All honor, therefore, to the men who so perseveringly and determinedly used it as did the builders at Venice for three centuries! And all shame to us if we do not attempt for the future so far at any rate as to follow in their steps! So rare are any but shafted windows in Venice, that at present I hardly remember a single instance of a window with monials formed by the continuous moldings of the tracery; and it is obvious that this gave occasion, not only to the use of beautiful marbles — never so well used as in shafts — but also to the constant use of carved capitals. In domestic buildings, as I have before remarked, this arrangement of shafted windows is very valuable, because it suggests one obvious way in which we may unite traceried windows with the very newest arrangement of window frames or sashes in the most comfortable nineteenth-century houses; for in these Venetian palaces the glass was always contained in a separate wooden frame set within the marble shafts and tracery.[1]

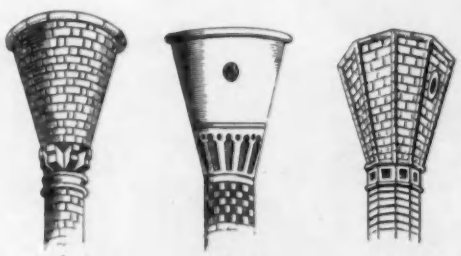


fig.1 fig.2 fig.3

CHIMNEYS, VENICE.

(*To be continued.*)

PERSONAL.

MESSRS. A. M. F. COLTON & SON, architects, have removed to Suite 802, Reaper Block, Chicago.

MESSRS. PARKER & AUSTIN have removed to Hobbs Building South Michigan Street, South Bend, Ind.

[1] This arrangement is not by any means unknown in Northern Europe, though certainly uncommon as compared with Italy, where it was almost universal. There is an example of the thirteenth century at Easby Abbey, Yorkshire, and another at Oakham Castle, whilst in France the ancient houses at Cluny all have it; and at Ratisbon, one of the most interesting cities in Germany, a great number of houses of the twelfth and thirteenth centuries, prodigious architectural interest, have it.

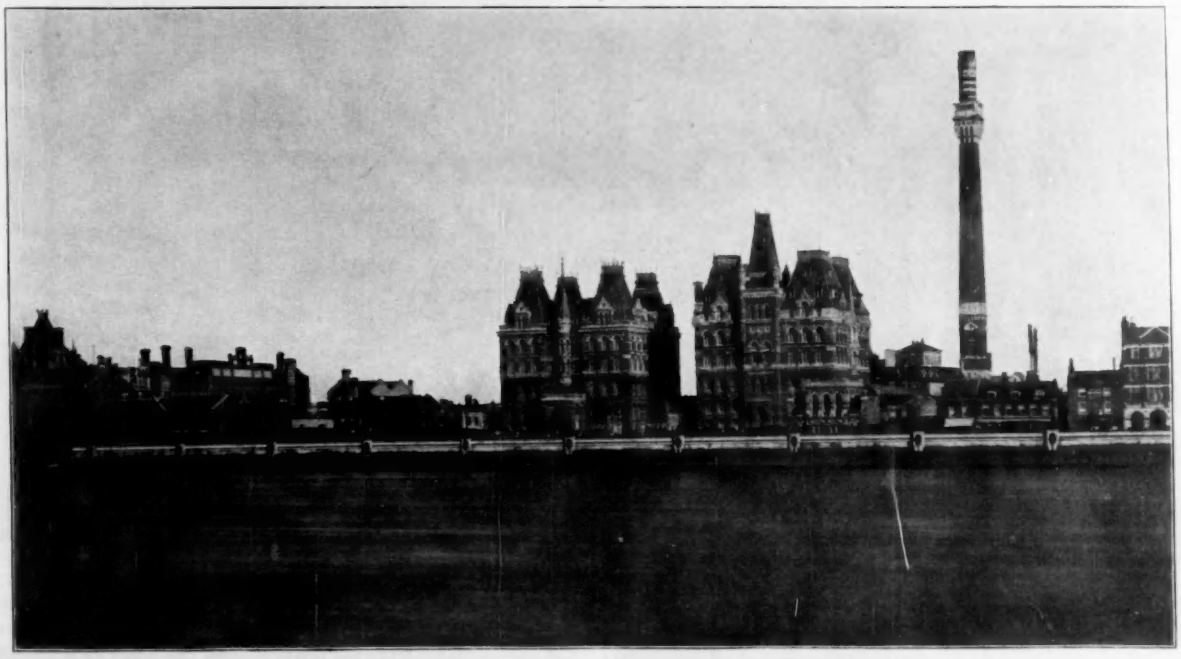
ARCHITECTURAL TERRA-COTTA.

BY THOMAS CUSACK.

(*Continued.*)

WE are indebted to the courtesy of Doulton & Co. for an excellent photograph of their headquarters at Lambeth, the central feature of which we are thereby enabled to illustrate. The firm has important branches in various parts of England; one in Scotland, another in France, employs a total of about four thousand heads, with presumably twice that number of busy hands, engaged in manufactures of clay.

The point from which this view seems to have been taken is not far from the spot chosen by Turner for the subject of his first exhibit at the Royal Academy in 1790, followed a few years later by another from the same neighborhood, entitled "Moonlight, a Study at Millbank." In both of these, needless to add, the present buildings are conspicuous only by their absence; so also is the massive stone wall forming part of the Albert Embankment. In the foreground, however, Father Thames flows on, eastward to the sea, less limpid, we fear, than when the Romans encamped upon its banks, but venerable withal in the eyes of English-speaking people. Since that time it has been a silent witness, often, indeed, an active participant, in the early struggles, the wondrous growth, and the globe-encircling enterprises of the Anglo-Saxon race. American Line passengers, on their way to London via Southwestern Railway, will obtain another and more comprehensive view of these brick and terra-cotta buildings. They lie between the railroad and the river, and will be seen to advantage just as the train slows down before entering the terminus at Waterloo station.



HEADQUARTERS OF DOULTON & CO., LAMBETH, ENGLAND.

We are fortunately able to give another of Mr. Tinworth's conceptions, of an altogether different type. In it he has told the story of Cleobis and Biton in a severely classical bas-relief, treating it in a becomingly chaste and impressive manner. The sacred oxen not being available, the pious sons of Cydippe, the Priestess of Juno, yoked themselves to her car, and are represented as falling in exhaustion or death, on the steps of the temple, during their mother's prayer, rendered in a poetical version by Mr. Edmund W. Gosse: —

"Hear me, and grant for these, my pious sons,
Who saw my tears, and wound their tender arms
Around me, and kiss'd me calm, and since no steer
Stay'd in the byre, dragg'd out the chariot old,
And wore themselves the galling yoke and brought
Their mother to the feast of her desire;
Grant them, O Hera, thy best gift of gifts."

Mr. John Bell's famous group America, one of the four pieces of colossal statuary flanking the base of the Albert Memorial, Hyde Park, was reproduced in terra-cotta by Doulton & Co. for the Centennial Exhibition. It is now in the Smithsonian Institute, Washington, where we remember having seen a pulpit and staircase, also executed by this firm, and deemed worthy of a place in our national collection.

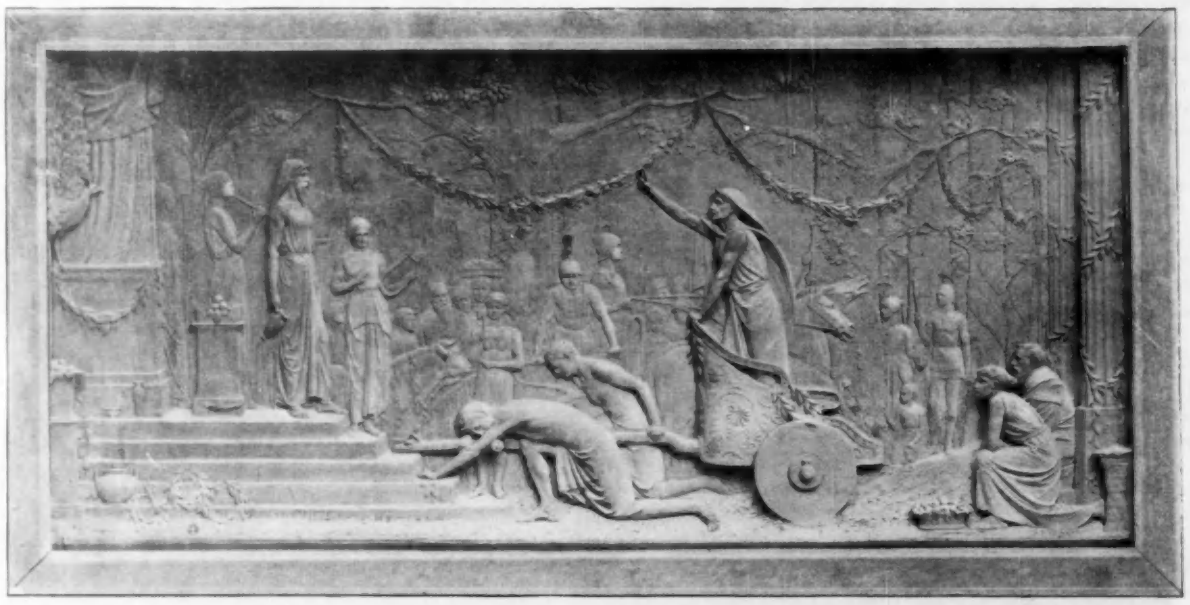
There is a statue of Sir Richard Crosby standing in a niche in Crosby Hall, Bishopgate Street, London. Of the countless number to whom it has been a familiar object, few are aware that it is terra-cotta, and fewer still that it was made in the early days of the Lambeth potteries. It has stood there unscathed for more than sixty years, impervious alike to frost, rain, sunshine, smoke, and yellow fogs. The same may be said of the colossal figure of Britannia on the Liverpool Exchange, executed early in the present century by Coade & Co., Pedlar's Acre, Lambeth. From this same works came the frieze of the Italian Opera House, London, and the well-known panels in Merrion Square, Dublin, dated 1788. The latter have put to shame the surrounding moldings, though in granite from the Wicklow Mountains. A similar comparison will be forced upon any one who has seen the terra-cotta vases in front of Buckingham Palace. They were made by Blashfield more than forty years ago, and are still perfect, while the Yorkshire stone coping on which they stand had long ago begun to crumble.

In marked contrast to these examples of terra-cotta, is the behavior of the crystalline magnesian limestone of which the Houses of Parliament are built. Sir Charles Barry's otherwise magnificent structure is not quite fifty years old, yet for more than twenty the exterior has been undergoing repairs. A special appropriation of $350,000 was afterwards set apart, producing a yearly income of $12,500, which hardly suffices to pay for a renewal of the stonework.

This stone was selected on the recommendation of a royal commission, after an exhaustive scientific inquiry into the product of every quarry in England. Yet the sulphurous vapors of the great city had attacked the beautifully carved crockets and spirelets, etc., before the whole of the scaffolding had been removed. The stone and marble that lasted for centuries in Greece, and under Italian skies, will not stand as many decades in the damp and fitful atmosphere of the British Isles, or the still more rigorous climatic alternations of America. Whether we take the obelisk on the Thames or the one in Central Park, New York, though both of Nubian granite, the effect is the same. Notwithstanding the various "preservative" solutions that were applied, they have suffered more during the past twenty years than they had done in the previous twenty centuries of their existence in Egypt. From present indications, it will not be long before the hieroglyphics of Thothmes III. will have wholly disappeared from the sides of the last-named obelisk, while the imperishable tablets in burned clay, some of which may be seen in the adjacent museum of art, will remain the only written record of the Pharoahs.

The decay of stone has become rapid and general in modern times, and is every day more noticeable in or near the great cities. This is owing, in part, to the vast consumption of coal, and the imperfect combustion of its gases, to which may be added the enormously increased production of corrosive chemicals, and the extent to which they now enter into the arts and industries of all manufacturing centers. Failing to find an antidote for these volatile but destructive acids, architects began looking for a feasible substitute to use instead of stone. They found that nature had already provided the raw material from which one could be made, though, oddly enough, most of it lay in close proximity to the coal itself. The deposits of fireclay found in hard nodules, and sometimes in the formation of shale in the coal measures of Lancashire and Yorkshire, had been used, when it was used at all, for furnace lining and coke ovens, previous to 1842. About that time, Mr. Edmund Sharpe, an architect of eminent attainments in his day, acting upon the suggestion of a colliery proprietor, undertook to use some of this waste product of the mine in the erection of a church at Lever Bridge, near the cotton-spinning town of Bolton.

It was a bold and hazardous undertaking, and must have ended in disaster had it not been pursued with a resolute perseverance worthy of Palissy, and directed by the practical mind of a man who was an architect, in a sense that we fear has been too often "more honored in the breach than in the observance." Of trained help he had none; for until then there had been no demand for such services, and, therefore, no supply had been called into existence to meet it. Brickmakers on the one hand, potters on the other, with now and then a man possessing useful knowledge gained in a mason's yard, was about all he had from which to make a selection. Like the currier in the fable who maintained that in fortifying the town there was "nothing like leather," the mason had a natural bias in favor of stone, which rendered him less useful than he otherwise would have been. Model and mold makers were drawn from the ranks of house plasterers, who, of all the trades connected with building, are, perhaps, the most deficient in a knowledge of geometrical principles, and whose original stock in trade, in so far as terra-cotta making is concerned, was doubtlessly summed up in their ability to gauge a bowl of plaster. The pressers and finishers of those days must have been equally crude and inept in their initial attempts to turn out constructive forms with any approach to mechanical fitness. In the modeling of architectural ornament he was also placed at a disadvantage, which we (with an increasing supply of men from the art schools of all Europe) hardly know how to appreciate. The spirit of the master masons and carvers to whom we owe the English abbeys and cathedrals, from Salisbury, York, and Lincoln, onward to the chapel of Henry VII., has rarely been equaled, and never excelled, in any country, but it, alas, had long since died out. Architecture as an art had not arisen from the depths to which it had sunk under the Georges. The men of the Victorian era, who, as carvers in wood and stone, have done some creditable work that goes far to redeem their age and nation from the charge of being art-less, had not yet made much headway. Really capable men of that class had turned their faces towards the metropolis, with its wider opportunities and more tempting rewards. Certainly few of them were available fifty-four years ago in the manufacturing districts of Lancashire. Finally, he had kilns to build in which to burn his first experimental blocks before he could even guess where he stood for shrinkage, to say nothing of the judgment necessary to turn out successive burnings with anything like uniformity in size and color.



"CLEOBIS AND BITON," BY TINWORTH. BAS-RELIEF EXECUTED IN TERRA-COTTA BY DOULTON & CO.

Mr. Sharpe was a thoroughly equipped architect, however, and in the course of his professional studies had become acquainted with

the medieval terra-cotta of Italy; but beyond the medallions, vases, busts, and statuettes, such as have been cited, he had no native architectural precedents, and no examples for its use on anything like so large a scale as he proposed to employ it. But this was about the beginning of the modern Gothic revival, and being a man of independent thought, he saw no adequate reason that could be urged against the concurrent revival of a building material equally orthodox, and of much greater antiquity. In practise he found it capable of meeting every requirement of sound construction, and at the same time susceptible to the most delicate touch of an artist familiar with Gothic forms and foliage, whether he took for his prototype examples from the beginning of the thirteenth or the end of the sixteenth centuries.

What a satisfaction it must have been to the architect to know that the final result of the whole undertaking was crowned with success, notwithstanding the many difficulties that had to be faced and overcome. It will be conceded that Mr. Sharpe was a pioneer in what must have appeared a discouraging enterprise, at a time when the making of terra-cotta was something of a *terra-incognita*. Not only did he establish a new industry, which has taken root in, and has followed the flag of his country, but one that has spread with even greater rapidity in America from Atlantic to Pacific, to the displacement of frames and shingles, and the substitution of fire-resisting structures, with embellishments undreamt of fifty years ago, Whether taken by itself, or in conjunction with iron and steel, it may be said without exaggeration that the durability, the adapta-

"AMERICA," EXECUTED IN TERRA-COTTA.

bility, and the degree of perfection already attained by this material, has within that short period revolutionized the architecture and building methods of two hemispheres.

This church, which is in many respects unique, was techinally described by the architect himself, in an address delivered before the Institute of British Architects in 1876, or thirty-two years after its completion, and from which we make the following interesting transcript. "This church was commenced in 1842 and completed, consecrated, and opened for public service in 1844. It is very easy to state this in a single sentence, but what is not at all so easy to do is to describe to you all the difficulties we had to encounter, all the laborious work we had to go through before this result was accomplished. It was, I believe, the first work of the kind in modern times in which terra-cotta had been used on so large a scale; for, with the exception of the foundations and the rubble work between the outer and inner faces of the walls, neither stone nor bricks were used, and with the exception of that under the slates, there is not a square foot of plaster in the building, the face of the walls inside and outside being formed of fire-clay blocks, in 5 in. courses, well bonded into the rubble work, and built like an ordinary ashler wall. It is a small cruciform church, with an apteral or aisleless nave, and a short chancel, north and south transepts, and west tower and spire. It is designed in the style of the early part of the Curvilinear period, *circa* 1320, with a spire of open tracery work, crocketed pinnacles, deeply molded door and window jambs, parapet of open tracery, traceried windows, and all other detail characteristic of that period, fully carried out. The four arches of the crossing are formed of continuous arches of two orders, carrying the Curvilinear ball-flower in one of their hollows. A trefoiled arcade runs round the three sides of the chancel below, and the north and south walls above carry a series of crocketed tabernacle work having niches intended for memorial brasses. All these works are in terra-cotta. The font, which is an octagon, richly diapered and paneled, is also in terra-cotta; so also are the bench ends, with their panels and finials; and so are the traceried panels of the seat backs themselves, and those of the pulpit and organ case. Indeed, the communion table was originally a terra-cotta structure, but it was objected to as uncanonical and ultimately removed, and replaced by a wooden table. . . . The most remarkable feature of the church, no doubt, is its traceried spire, which is built of solid terra-cotta from top to bottom, doweled together, not with iron, which is much less durable, not with copper, which is much more costly, but with terra-cotta dowels, which are imperishable. The six four-light traceried windows of the tower, transepts, and east end, and the two light windows of the nave, are treated in the same way. The church contains sitting accommodation for three hundred persons, and cost, as it now stands, £2,600. What it would cost in stone I never took the trouble to calculate; but the spire alone would, I should think, cost as much as the whole church has. Looked at as a piece of ordinary mason's work, it would be difficult to find a fault with it; nor would a stranger, seeing it for the first time, deem it, either from the appearance of its color or its workmanship, to be anything else. Its primitive color, when first built, was a ruddy buff, which isnow considerably deepened by an exposure of thirty years to the smoky atmosphere of Bolton-le-Moors."

The quarrymen, stonemasons, and plasterers became alarmed lest their occupation should be interfered with, though all the time affecting to regard the innovation as wildly Utopian, if not downright worthless. In this they were supported by that class of the community who, a few years before, had taken the side of the cow, as against Stephenson's locomotive, and who in another relation was once dubbed by Disraeli "the stupid party." As a result, and by common consent, this became known among them as — The Pot Church. In this, history was but repeating itself, and human nature was engaged upon an object lesson, to show that in reality it is much the same in all ages and nations. When Girolamo della Robbia, a grandnephew of Lucca, and an architect as well as a sculptor, built the Château de Madrid, on the Bois de Boulogne, for Francis I., the same thing happened. In it, also, terra-cotta had been extensively used, and the loggia was decorated with sculptured enamelled earthenware. For this it was nicknamed derisively by De Lorme, *Château de faïence*, and by this it continued to be known until destroyed by fire, in 1792.

(*To be continued.*)

Home Study is the title of a new periodical, the initial number of which makes its appearance this month. Its purpose is to provide through its columns an elementary study of civil, mechanical, steam, electrical, mining, municipal, bridge and railroad engineering, architecture, land surveying, mechanical, and architectural drawing.

It is published monthly, as an adjunct to The International Correspondence Schools, at Scranton, Penn., and, judged by its first number, will prove itself of great value to those desiring to take up these studies, but who are unable to take a course at some one of the larger colleges.

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Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

HIGH BUILDINGS.

BY C. H. BLACKALL.

WITHIN the past few months there have appeared in the various architectural publications a number of articles treating of the subject of high buildings. The term is used in the Chicago sense, implying buildings of fourteen stories and upward. These articles have come from architects and engineers who stand so high in their respective callings that whatever they say upon the subject is worthy of the most careful consideration. There seems to be a unanimity on the part of these writers to look discouragingly or with slight approval upon high buildings as a class, to consider them not only of doubtful expediency, but as in many cases a positive danger. Nor are there lacking evidences that legislative action is being considered which shall be intended to entirely prevent the future erection of buildings of more than a moderate height. Indeed, some cities have already passed laws of a restrictive nature. Boston does not permit of any building being erected over 125 ft. in height; Chicago recently restricted the height to 130 ft., but has since extended it to 150 ft., if I am correctly informed, and there has been a good deal of agitation in New York looking to the same direction. It is a subject which has engrossed a good deal of attention in the public press, and the daily papers, which are very quick to reflect any passing spasm of public opinion, have had a good deal to say about these "sky-scraping monstrosities," or by whatever other term the reporter's fervid imagination can picture them. The statement is reiterated that fire-proof buildings are not fire-proof; and the assumption is frequently made that some day there will be a tremendous catastrophe as a result of a conflagration in connection with some of the sky scrapers. We are told also that the buildings are not structurally safe, that it is not possible to guard the skeleton upon which they depend for strength from the insidious attacks of moisture and long-continued vibrations. And to sum up the evidence which is alleged against high buildings, one could very easily form the idea that our architects and constructors had lost their wits in dealing with this comparatively new problem, and that our large cities were being filled with structures which gratify only the immediate pecuniary interests of the owner, and possibly the personal pride of a few architects, at the expense of durability, safety, and public economy. It is an exception to find an architect who will say anything in favor of tall buildings, and yet the problem which they present is of so engaging nature, the possibilities which they place within the reach of the designer are so far in excess of anything which ordinary commercial architecture can offer, and the processes of construction, when rightly applied and thoroughly understood, are so eminently and scientifically satisfactory, that even in the face of the sentiment which seems to be growing against permitting their continued production, the question can fairly be asked whether there are not desirable elements in these sky scrapers, and whether the fault with them is not in the manner in which they are designed rather than in the problem itself.

The first requisite of all modern commercial buildings, even of restricted height, is that they shall be absolutely noncombustible, and, as far as possible, fire-proof. No one term is more persistently misapplied and misunderstood by the general public than the designation of fire-proof. Every day we hear buildings quoted as fire-proof which we know are inflammable to the highest degree. So much prominence has been given to the necessity of a construction which cannot be affected by fire, that, in the newspaper mind, every substantial pile of masonry which has the appearance of being solidly built is assumed to be up to the standard of fire resistance. But a mere lavish use of porous terra-cotta and iron will not make a building fire-proof. So long as we are obliged to use steel in the skeleton, the resistance of the building can be measured only by the protection of the most exposed portions; and as Mr. Adler very aptly says in the *Inland Architect*, "When structures intended to be 'slow-burning' burn quickly, and when 'fire-proof' buildings are materially injured or nearly destroyed by the burning of their contents, or by fires in neighboring buildings, we cannot evade the conclusion that the current theory and practise of 'slow-burning,' and of 'fire-proof' construction must be modified." As a matter of fact, many of the theoretically fire-proof buildings, — I use the term in the technical rather than the absolute sense, — while, following the principles which modern constructive science has demonstrated as most reliable, are so deficient in absolute protection that their resisting qualities are of doubtful value. That a building can be so constructed that no fire from within can seriously damage its construction, and which will be proof against any ordinary fire from without, unless it be a general conflagration, seems to be pretty well established by the data cited in Mr. Adler's article in the *Inland Architect*. "The fire in the club house of the Chicago Athletic Association"— which offers a most conclusive test of our modern systems, — "occurred under peculiar and rather unusual conditions. The building was full of wooden scaffolding, and of acres of wooden wainscot, wooden doors, and combustible finishing material of all kinds, all stored in the building, some set in place, but most of it standing and lying about, while chips, shavings, etc., were scattered all over the building; everything in the best possible condition for quick combustion. The fire, therefore, spread quickly and burned fiercely. Everything combustible was consumed, and, as in the Schiller Building, the hollow fire-clay tile was chipped and cracked, and left the structural metal exposed to the action of the fire, from which it suffered some injury, but not enough to seriously impair its carrying power."

Now, while such an example is quite sufficient to demonstrate that, for existing conditions of occupation and use of buildings, it is impossible to construct any structure which is unqualifiedly "fire-proof," it also shows that when the structural metal work is properly protected according to the best experience of modern practise, the possible damage from fire, even under very extreme conditions, is reduced to an insignificant minimum. So far as I know, there has never yet been erected a building entirely devoid of combustible material. We still use wood for our doors, our windows, and generally for our finish and the finished floors. Also, the contents of a building is always of an inflammable nature. It is possible to avoid wood entirely, using marble or iron finish and iron doors and windows, and, perhaps, as has been suggested by Mr. T. M. Clark in a very able paper presented to the American Institute of Architects, we might substitute for ordinary glass, which will break and allow flames to pass, some form or variety of the recently produced wire glass which preserves its surface intact. The main constructive reliance of the building is, however, on terra-cotta, which, notwithstanding the advent of various other fire-proofing materials, still remains the most satisfactory material with which to clothe our steel skeleton.

The recent fire in the Manhattan Building, New York, while cited as an instance of a fire-proof building which was not fire-proof, was, in fact, a demonstration that the terra-cotta envelope really does efficiently protect. The report of Mr. S. A. Reed, published in the *Journal of Commerce and Commercial Bulletin*, is quite conclusive. The girders of seventh and eighth floor were unprotected and failed under the influence of the excessive heat. "Below that point I judge that the damage is confined to finish, trim, and exterior ornamentation, but is not structural. Had the girders and roof beams of this building been properly protected, I think most of the damage to the building would have been other than structural."

In the light of such evidence, it seems hardly fair to object to high buildings on the score of their fire-resisting qualities. We can never be relieved entirely from risk in any human habitation. We cannot conduct business in a structure built like a blast furnace. We must have abundant light and air, and the dangers from fire incurred in a tall building of fire-proof construction seem to me no greater than exist in a four or five story structure, and are surely far less than were endured for generations before modern construction was developed.

As regards construction, the high commercial structures of to-day are built on precisely the same lines which have been followed for upwards of half a century in erecting bridges. The ancients did not have iron to use in the lavish manner which is possible nowadays; but as a comparative construction, it is safe to say that the post and girder system adopted in nearly all architectural structures to-day is safer, stronger, less liable to be influenced by external shocks or internal commotions than any form of masonry construction, as such, which the world has ever seen. Surely no constructor will undertake to say that a tall building, if carried, even to a thousand feet in height, cannot be made of sufficient strength to withstand all that will ever be put upon it; and the use of the steel skeleton, continuous from bottom to top, permits of a certain flexibility in the construction, the value of which I think may not be fully appreciated. As regards the life of the steel when embedded in the masonry, we know that under some conditions steel has endured for ages; and while we also see abundant evidences that steel and iron beams will rust entirely away in a comparatively few years, there are always special and easily appreciated reasons for such dete-

rioration, arising from conditions which experience tells should be and are avoided in the best arranged and constructed buildings. The expansion of the iron or steel under heat is quoted as an argument against its use. The objection is theoretical rather than practical, for the terra-cotta envelope expands as well as the metal, the rate of difference being only about one two-hundredth of an inch per foot for a change in temperature of 100 degs., which is equivalent to ¾ in. in 150 ft., or, at the most, $\frac{1}{10}$ in. per story, an amount too small to be considered. As a matter of fact, the range of temperature of the steel is less than 40 degs., which reduces the expansion to $\frac{1}{40}$ in. per story.

I would not be understood as saying that all high buildings are safely constructed, any more than that they are all fire-proof. Some of the structures erected in recent years are constructively a disgrace to the profession. Mr. Alex. Rice McKim, in a letter to *Architecture and Building*, says that "many of the so-called modern office buildings which we see about us are anything but well constructed, and the collapse of one of these would throw the whole system into disrepute, cause a stampede from the office buildings, and injure the profession considerably." This is one of the evils incidental to the practises of a profession which is open to every one who chooses to consider himself qualified.

From a business standpoint, no one can question the desirability of concentration, and this the sky scraper does most effectually. People may grumble at the shadows cast by the huge structures, and may even collectively, say that they ought not to be tolerated or allowed, but they answer a public necessity. The best commercial warrant for their being is afforded by the manner in which they rent, and we have only to look at the experience of nearly all the tall buildings which have been erected, to see that however much they may be objected to in theory, as a matter of fact, the top offices are the ones rented first, those nearest the ground bring the most money, and the ones which pay the least are midway, or at about the height of what we used to call tall buildings a few years ago. The possibilities of these buildings has so enormously increased the earning capacity of the land, that property which would hardly carry itself in former times on a valuation of one hundred dollars per foot, can now be made to yield a handsome surplus on a valuation of three hundred dollars, while modern machinery and business methods have made it possible to erect these excessively tall structures at a less price per cubic foot than was the rule a few years ago with buildings running up only 80 or 90 ft.

There remains, therefore, only one valid objection to the high building, the question of fitness in an esthetic or public sense. An architect who was for years at the head of his profession in Boston, whose word was accepted almost as law among real estate investors and all who had to do with real property, was quoted to me as having said he did not believe it wise to put an elevator in any commercial building; that if people were too lazy to walk up two flights of stairs they ought to stay outside, and that in no case did he think it advisable to carry a building up more than three stories. If I recollect rightly, the highest structure he ever built was not over six stories. Whether he built it under protest I could not say, but there is no reason to doubt that the sentiments which he felt were substantially as I have stated above. This was said before the first sky scraper was built in Chicago, and at a time when a building 80 ft. high was thought to be very high for Boston. It need hardly be added that this distinguished architect's views were speedily relegated to the past as the possibilities of modern commercial structures made themselves manifest. Nor is it likely that any architect of to-day would take so extreme a position; and yet the jump from a three-story to a nine-story building meant a great deal more in the architectural development of this country than has been implied by the transition from a nine to a nineteen story; and it is less of an achievement to-day to erect a structure 350 ft. high than it was a decade ago to build one 100 ft. high. Is it not then possible that we are not considering this problem right, and that by condemning the tall building, as such, we are taking a stand which in the future may seem as irrational as the position in regard to elevators previously quoted now seems to us.

Let us consider for a moment what the problem means. Reduced to its barest commercial elements, it is simply to get the greatest number of people safely housed in offices upon a given lot, utilizing every foot of space possible of land, which will often run up to nearly three hundred dollars per square foot. That is the economic problem. Architecturally, it means to design a tower, not very high in comparison with other towers, as such, but divided into numerous low stories, each of which must be recognized on the exterior in some way. I confess I do not appreciate the feeling which would prompt an architect to belittle the opportunities afforded by a high building. In no other department of art is mere size and mass as worthy of consideration as in architecture. Expanse or magnitude has very little to do with the intrinsic qualities of a painting or a statue, but an architectural creation which is simply immense, even though it be lacking in proportion, detail, and arrangement, is impressive, and may be noble as a design. The best illustration of this quality of architecture is manifested by the works of the Egyptians. Mere size is so great an aid to dignity in architecture, that the fact that we can logically carry a building up to a height of 300 ft. above the pavement ought not to be considered a calamity. If we were designing a cathedral, there surely would be no impropriety in carrying a tower up to 400 or 500 ft. I admit the essential difference between a cathedral, which is nearly always an isolated structure with abundant space around it, and a modern office building which is crowded into the narrowest possible compass and circumscribed by the limitations of an ordinary city lot. I admit the sentiment which would acknowledge the fitness of a church tower being carried up to the highest possible limit as a single structure, as compared with the seeming incongruity of piling stories upon each other like so many tables, but this is simply another way of saying that our tall office buildings are not designed right and are not placed right. Considered of themselves, irrespective of their surroundings, I do not believe a nobler, more inspiring problem has ever been presented to architects than is afforded by these huge structures. Let any one walk down Nassau Street from City Hall Square, or look up at the Ames Building from the corner of Devonshire and Congress, or pass under the shadow of the mighty Masonic Temple at Chicago, and he must be prejudiced indeed who can deny the grandeur, the intrinsic nobility of the structures he will see. I know all would not agree on questions of mass and of detail, and we are bound to admit that our streets are not desirable when they are turned into cañons; but the buildings themselves are certainly noble creations of a type which the world never has seen before in just such form.

It must not be assumed that the present is peculiarly an age of high buildings, for we cannot forget the numberless buildings of the past which are recognized as monuments, in every sense of the word, but which far excel in height everything which this country has ever produced, with the single exception, perhaps, of the Washington Monument, which, by the way, is not truly an architectural structure. The dome of the cathedral of St. Paul's, London, is 363 ft. high, St. Peter's, Rome, 435 ft. high. Both of these are buildings presenting considerable constructive difficulty; in fact, a dome put upon stilts and carried on arches is one of the most insecure forms of building which human ingenuity has ever devised. The towers of Cologne Cathedral are built up solidly to a height of nearly 400 ft., without counting the spire; and we have the enormous Victoria tower of the Houses of Parliament carried to a height of 340 ft., while from the remote antiquity we have the Pyramids of Egypt, which are about 484 ft. high. In other words, there are not lacking monuments of the past which are sky scrapers in a literal sense, but which are acknowledged to be art creations and thoroughly well constructed. So the modern sky scraper, while it may be new in the sense of its adaptation to office purposes, is not new in the slightest degree as regards dimensions.

The New York Chamber of Commerce recently passed some resolutions which are so pertinent and express so fitly the esthetic objection, as I understand it, to the high buildings, that they are worth citing. The first is, that the State legislature should pass a law limiting the height of buildings in proportion to the width of the street and according to location; and second, that all buildings over 80 ft. high should not occupy more than eighty per cent. of the area of the lot or lots upon which any one building may stand. If these resolutions could be carried out in effect, it would not by any means imply that high buildings should not be built; but rather, when a property owner makes up his mind to carry a structure to the height of three or four hundred feet, that he must consider his neighbors, and the general effect upon the street upon which he is to build, and must erect a structure which shall be in harmony with the general aspect of the city, rather than to stick up like a sore thumb, in the painful manner so evident on some streets. I believe in the high building, I believe in it architecturally, structurally, and esthetically when it is properly placed and designed, and I cannot believe the high building need be condemned as such. Very few of our tall office buildings are in accord with their locations and surroundings, but this is more due to the selfishness of the owners of high cost land than real lack of appreciation by the architects. We do not need to reduce the height of buildings, but rather, we want to reform the public taste and the greed of capitalists, so that we will design our tall buildings as monuments and not as mere money mills. We want high buildings. It is impossible, under existing conditions, to carry on business in the structures which our fathers found sufficient to their wants. Ten stories is not enough for modern commercial needs, and I will not believe that the possibilities of architecture are so barren a way cannot be found to carry up our buildings twenty or thirty stories, if necessary, without sacrificing the unity which ought to prevail in a well-regulated city.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Continued.*)

THE CHEMISTRY OF CEMENTS.

IN the American Cyclopædia, Vol. IV., page 185, the following singular theory will be found attributed to MM. Rivet and Chatoney: "Where cements are calcined at a high heat, silicate of alumina and silicate of lime are formed, which on the addition of water undergo decomposition with the formation of aluminate and silicate of lime, containing each three instead of six equivalents of water, which is the case when a heat only sufficient to drive off the carbonic acid of the carbonate of lime is employed; and the decomposition which must take place before the final hydration also explains the slow setting."

We thus have here a variety of opinions which to the lay mind must give rise to conjecture, at least, and to those who take a deep interest in the subject, and who desire to arrive at the truth, must certainly open a wide field for research and experiment.

With a view to the acquirement of some knowledge of a practical nature in regard to this question of chemical combinations, the author instituted a series of experiments, which, being entirely mechanical, except as to the analyses, were more or less crude.

One of these consisted in filling a gallon bottle with three quarts of rain water, into which were gradually sifted a few ounces of natural rock cement which had been calcined to an unvitrified clinker and ground exceedingly fine.

The bottle was shaken vigorously and continuously for several minutes, thus giving the water ample time to act on the powder before the latter was allowed to settle. This operation was repeated at frequent intervals to avoid a setting of the cement, as would have been the case if left undisturbed. The following day the water was poured off, and a new supply used. After the third washing the cement was dried and submitted for analysis.

Previous to the experiment the cement had been carefully analyzed. The following table gives the analyses. No. 1 before, and No. 2 after, washing.

	No. 1.	No. 2.
Silica	24.30	26.01
Alumina	6.62	7.07
Oxide of Iron	2.41	2.16
Lime	52.35	51.97
Magnesia	6.16	6.52
Potash and Soda	5.30	2.77
Carbondioxide	2.10	2.26
Loss	.76	1.24
Totals	100.00	100.00

The constituents which show an increase in percentages are those which sustained no loss in the washing, while those which show a decrease lost a portion in the operation, which becomes more noticeable when illustrated by ratios.

	No. 1.	No. 2.
Ratio of silicic acid to lime, as	10 to 21.5	10 to 19.9
" " " " " alkalies, as	10 to 2.17	10 to 1.06

The ratios as between silicic acid and the magnesia and alumina are practically constant.

It is not contended that this experiment is at all conclusive, but it furnishes evidence that magnesia and alumina were chemically combined with the silica, else they certainly would have been washed out, or at least partially so.

The loss of 7.45 per cent. in the lime amounts practically to the excess above its true combining ratio with silicic acid, which is as 10 to 18.6.

The prime object of this experiment was to determine the truth or falsity of the theory so often advanced, that the magnesia and alumina are inert substances in a cement, and the results demonstrate that, by a careful system of washing, all inert or uncombined matter may be removed.

The fact that neither magnesia nor alumina are separated from the silica except by the use of acids, as in analysis, should be a sufficient refutation of the idea that either of those constituents are free and inert in a cement.

The difficulties in the way of a settled theory concerning the fabrication of a cement are furnished by the almost interminable variations in the percentages of the constituents, silica, alumina, lime, and magnesia.

A study of the table of analyses will disclose the fact that no two cements are alike in this respect, and every change from some fixed standard, with the varying action due to that divergence to be accounted for, involves the subject in doubt, and opens the way to endless discussion among those who make a study of the chemistry of cements; while engineers, architects, and others who are in a position to determine the brand of cement to be used, are guided by practical experience in the use of the various brands, paying but little regard to the chemical side of the question.

They find that for some purposes one brand of cement answers, while for another class of work some other brand is preferred. It matters little to them whether one brand contains a greater or less amount of magnesia or alumina than the other. They desire a satisfactory result, and, as a rule, are far less prejudiced than any other class connected with the art.

A cement manufacturer who does not fully and unequivocally believe his own production to be in every conceivable way superior to all others is yet to be found.

It is a fact familiar to all who are interested in the subject of hydraulic cements, that the question of quality is ordinarily determined by tensile strain test. It is a convenient method of reaching conclusions as to the relative values of different brands of cements.

That slight attention is given to the analysis of a cement is due to the fact that a mere analysis, as it appears in a table, does not convey to the average mind any definite meaning.

And when several analyses are compiled in one table, there is a confusion of ideas as to the significance of the almost endless variety of compositions that exist; and it is not difficult, therefore, to account for the almost universal use of the tensile-strain testing machines.

It should be understood that an analysis stands mainly as a basis for further calculations. That it is but the statement of a problem, the conclusions of which, when worked out, will disclose the percentages of silicates or active setting matter in the cement, and, consequently, the percentages of inert substances; for that the constituents, silica, lime, magnesia, and alumina do combine chemically in fixed proportions, is a fact established beyond all controversy.

If all cements were found to contain these constituents in true combining proportions there would be but little left to be said on the subject. But as such conditions are rarely, if ever, met with, the most that can be done toward arriving at actual values is to determine, from a given analysis, the amount of silicates, and the amount and kind of inert matter present.

When a system for so doing is clearly understood, a long step will have been taken toward a clearer and better understanding of the actual merits of a cement.

It will then be discovered how utterly unreliable and misleading are the readings of a testing machine, unless held in strict subserviency to a superior knowledge, gained only by a thorough study of the chemistry of cements.

As a simple method for calculating the percentages of silicates in an hydraulic cement, the analysis of which may be given, we have prepared the following formulæ, which will be found to serve the purpose.

COMBINING RATIO OF THE VARIOUS SILICATES.

SILICATE OF LIME.

A.		B.	
Silica	1.000	Lime	1.000
Lime	1.864	Silica	.536

SILICATE OF MAGNESIA.

C.		D.	
Silica	1.000	Magnesia	1.000
Magnesia	1.330	Silica	.752

SILICATE OF ALUMINA.

E.		F.	
Silica	1.000	Alumina	1.000
Alumina	.566	Silica	1.764

BISILICATE OF LIME AND ALUMINA.

G.		H.		I.	
Silica	1.000	Lime	1.000	Alumina	1.000
Lime	1.864	Alumina	.304	Silica	1.765
Alumina	.566	Silica	.536	Lime	3.291

BISILICATE OF LIME AND MAGNESIA.

J.		K.		L.	
Silica	1.000	Lime	1.000	Magnesia	1.000
Lime	1.864	Magnesia	.356	Silica	1.503
Magnesia	.665	Silica	.536	Lime	2.803

TRISILICATE OF LIME, MAGNESIA, AND ALUMINA.

M.		N.		O.		P.	
Silica	1.000	Lime	1.000	Magnesia	1.000	Alumina	1.000
Lime	1.864	Magnesia	.356	Alumina	.852	Silica	1.765
Magnesia	.665	Alumina	.304	Silica	1.503	Lime	3.291
Alumina	.566	Silica	.536	Lime	2.803	Magnesia	1.172

(To be continued.)

THE MANUFACTURE OF CONCRETE.

MIXING.

THE mixing of concrete is as essential to success as the choice of the materials used for it. With unskilful methods there may be a vast amount of waste, both in the quantities of materials used and in the final strength of the concrete mass. It is possible to obtain as strong and as satisfactory results with a small amount of cement and a large amount proportionally of well-chosen aggregate as with a large amount of cement and haphazard mixing with ill-chosen aggregate.

In any good concrete the main object is to fill the voids. The spaces between large stone should be filled with smaller stone; these spaces so reduced should in turn be filled with sand of a coarse variety, and then the smallest spaces filled entirely with cement. Every piece of stone and particle of sand, therefore, should be coated well with cement, and the best results are obtained when there is not too much of any material,—stone, sand, or cement. Large masses of pure cement scattered through a mass of concrete shows a waste of good material, for a piece of good hard stone would do better work in the place of the mass of cement, and it would cost a fractional part as much.

There has been more or less discussion as to the kind of material that is best in concrete making. First, in regard to the size: For heavy and massive work, large stone may be used, sometimes as large as a man's head. Then the rest of the stone may be graded down so as to have the spaces between the stone well filled. The matrix should be composed of coarse sand, at least as large as the coarsest granulated sugar, and the cement should be thoroughly mixed with this sand before the mortar so formed is incorporated with the stone. Only sufficient water should be used to insure secure a stiff tenacious mass. It is often advisable to wet the stone and coarse material before mixing.

As for the kind of aggregate, that depends wholly on the use to which concrete is to be put. For heavy loads and masonry of high order, only hard broken stone, basalt, granite, etc., should be used. For fire-proof work, use broken brick, pottery, clinker, slag, and such material as withstands great heat.

For light floors, filling, etc., use crushed coke, clean cinders, etc. For heavy wear in pavements use pea granite or other hard stone. (See specifications in back numbers of BRICKBUILDER.)

There is a good deal of controversy at present among engineers as to the relative value of broken stone and round pebbles in making concrete. Tests have been made which show no practical difference in the strengths of concrete made under similar conditions with the two materials, yet judgment and reason would certainly choose stone in place of pebbles, for important work.

There is often a confusion of ideas in naming the proportion of the materials for making concrete, due to the fact that it is not generally understood that three parts of sand and six parts of coarse 2 in. stone do not make nine parts together. The voids in coarse stone amount to about 47 per cent. of the mass, or, roughly, 50 per cent., which means that it is necessary to add to a certain mass of stone nearly half as much sand in order to fill the voids without increasing the bulk at all. According to Trautwine, the following table gives the proper ratio.

1 cu. yd. broken stone with .5 of its bulk voids requires . .5 cu. yd. gravel or fine stone
.5 ,, ,, gravel or fine stone, with .5 of its bulk voids requires . . . . .25 cu. yd. sand
.25 ,, ,, sand with .5 of its bulk voids requires . . . . . .125 cu. yd. dry cement

So when a mixture is stated by the formula 1 — 3 — 6 — the result is a mixture of one part of cement to six parts of aggregate, and not of nine parts of aggregate, as might be assumed. This is a matter of much importance, not only in estimating, but in the strength of the concrete, for if one mixture is made of one part cement and, say, six parts of broken stone, and another mixture is made of one part cement, two parts sand, two parts of small stone, and six parts of large stone, the result of the second mixture will be far superior to the first in economy of materials, volume, and equal in strength. In all cases this idea should be developed to its fullest extent, where concrete is used intelligently.

Here, however, comes another idea of importance relating to the manner of mixing, whether it is to be done by hand or by machine. If it is to be done by hand, account is to be taken of the uncertain quality of the labor. The energy required for mixing concrete is excessive, and the work is very fatiguing. It is harder to handle stiff concrete than one which is soft. The temptation then is to use too much water, which drowns the cement and wastes it. The mixture should be turned a number of times to insure a thorough distribution of cement and to fill the voids uniformly. The tendency, however, is to save time and labor, and, consequently, to avoid mixing as much as possible.

These difficulties are largely obviated by using machinery of approved type. A large number of the mixers, however, consist mainly of a trough and a shaft to which are attached a number of paddles. This style answers well where large quantities of material are wanted without particular reference to its quality, as in street and reservoir paving, cable subways, etc. They are inferior mixers, and not economical where the full value of the materials is to be used.

ROSS F. TUCKER.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

CRACKS IN BRICKWORK AND PLASTERING.
WHAT CAUSES THEM, AND HOW THEY MAY BE PREVENTED.

BY A. H. DYER.—*(Concluded.)*

NO architect or builder would think of constructing a brick wall in the manner shown by Fig. 38, which represents a section of a 12 in. wall with a continuous horizontal chase or groove (A) running the full length of the wall, and extending to the outside course of brick, leaving out the center and inside courses the thickness of one brick. Such a form of construction would seem to be the height of folly, if not of criminal carelessness. The writer does not remember seeing an absolute case of this kind, but he was called upon to witness an example which practically amounted to the same thing. The example referred to was a two-story factory building with 12 in. brick walls and 2 x 12 in. floor joists resting upon a 2 x 8 in. bond timber built into wall, as shown in Fig. 39, all of the timbers being yellow pine. When this building was about four years old an accident happened which brought to light the fact that the first floor had *settled* near the outside wall, and for a distance of about 30 ft. and a further examination disclosed the fact that the ends of many of the joists, as well as most of the bond timbers, were almost entirely consumed by *dry rot*, and the latter in many cases to such an extent that the entire space formerly occupied by the bond timber could be readily "cleaned out" by using a piece of wire or hoop iron, and in some cases bare fingers could easily accomplish the same result. Many of the joist ends were in such a condition that, while at first they appeared to be sound, a knife blade could be easily pushed through them at right angles with the grain of the wood. With this state of affairs existing along almost the entire length of the wall, it must be admitted that *practically* the method of construction was the same as that shown in Fig. 38. The second floor was constructed in the same manner, and had begun to show signs of decay, but not nearly as bad as the first floor. The whole thing was "*fixed*" by setting props under the first floor joists, the bottom of props resting upon the top course of footings to outside walls, and closing up the cellar again so that the good work might continue uninterrupted. The above method of construction was no doubt adopted in order to get a "good bearing" for the joists, and at the same time save anchoring them, as each joist appeared to have been thoroughly spiked to the bond timbers. The writer several years ago saw another case where considerable "bearing" seemed to be needed, for the builder had run the second-story joists entirely through the wall, and the ends were painted and lined to correspond with the brickwork; the painting was very neatly done, and if the ends of the joints were dovetailed and wedged it could not be noticed from the ground, and it is quite possible that they were "draw bored and pinned" against the inside of the wall to prevent some one pulling them out when the owner was not looking.

When joists are built into the wall and secured with iron anchors it would be well to consider which method of anchoring is the best, and it should also be remembered that all joists and timbers resting in or on a wall should be "self-releasing" in case of fire or accident. One of the most common patterns of a joist anchor is that shown by Fig. 40; it might also be added that it is one of the worst, and a quite frequent result of their use is shown by Fig. 41. Fig. 42 shows a cheaper and also a better anchor than any "stiff" anchor for ordinary purposes; it is made of plain, round iron, with the inner end turned and driven into a hole of proper size in the joist; this anchor will allow the joist (if properly beveled) to leave the wall without acting as a lever, but the joist itself will not be released. Figs. 43, 44, 45, and 46 describe an anchor that is self-releasing, and one that will be self-adjusting in case of any ordinary settlement, and it is no more expensive than the old-fashioned "pry" anchors that are still quite extensively used. I examined a brick building not long since that had two heavy truss chords, which were anchored to opposite walls with very heavy anchors, two at each end, and secured by four bolts, the anchors being the same style as shown by Fig. 40. The center of these chords had settled to such an extent that the brickwork around each of the ends (four of them) was broken and pulled in to such an extent that the anchors did not hold one single pound more than the weight of the mass of broken brickwork immediately in front of them, and in all cases this brickwork was easily removed, as the fracture extended into the wall as far as the anchors did; this fracture could not have happened if an anchor similar to Figs. 42 and 43 had been used and properly adjusted. It will be noticed that in case of fire the expansion of these anchors, although it would indeed be very slight, will assist, instead of helping to prevent the release of the joist, and if properly set, it will also

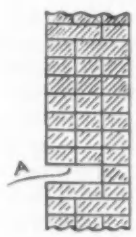


FIG. 38.

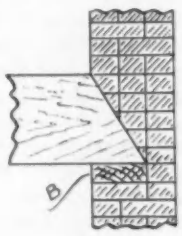


FIG. 39.

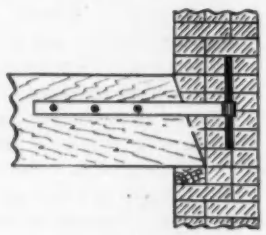


FIG. 40.

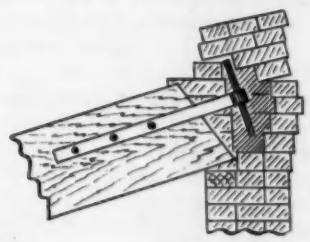


FIG. 41.

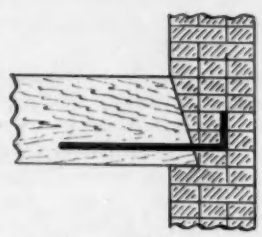


FIG. 42.

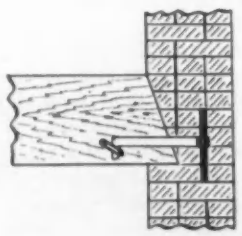


FIG. 43.

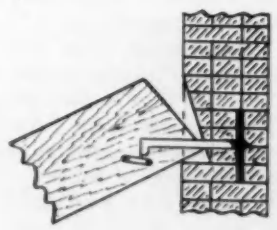


FIG. 44.

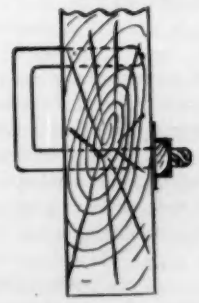


FIG. 45.

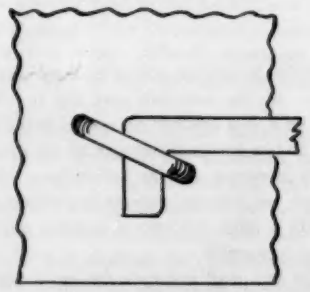


FIG. 46.

adjust itself to any reasonable settlement without diminishing its strength.

Again taking up the subject of cracks, we will investigate a few cases of defective flues. In constructing chimneys for frame buildings it should always be remembered that the footings of a chimney should have as nearly as possible the same load per square inch as the footings of the foundation walls have. But this is too often left to guesswork, and, as a rule, the figuring and guessing bring about very different results. Fig. 47 shows a very common case of defective chimney top, and is caused by "too much projection." Fig. 48 shows a first-class case of defective flue, and it is by no means an uncommon one; any settlement of the chimney is liable to cause the base D to ride the roof at C, and thereby cause a fracture, as shown, or at some point lower down, as the case may be. The unerring accuracy with which the courses usually "line up" with the top of the roof boards around the opening is something remarkable, and just why this method of construction is so persistently followed and so freely allowed is more remarkable still. Fig. 49 shows a similar case, where the opening was *almost* large enough, and the chimney was "wiggled through," with about the same result as shown by Fig. 48. Fig. 50 shows an example of "drawing over" so as to bring the chimney through the roof at some certain point. The inclined portion of the chimney is usually supported by plank at F, but no provision is made to keep it from sliding off at H, which will sometimes occur if the inclined part is too much out of plumb; and, again, if any settlement occurs the upper part of the chimney is liable to be "hung up" at G, or at almost any point along support F. Fig. 51 shows an *easy way* to get around a floor or ceiling joist without "bothering the carpenter," and, as incredible as it may seem, it is very frequently done, and thereby hangs another case of defective flue. Fig. 52 is another pronounced case, and it quite often leads to a "fire from unknown cause," just the same as Fig. 53, in which case the flooring is butted close to chimney; the plastering extends clear to floor, and is still more closely confined by the base and foot mold being nailed to flooring and joists, and it then becomes a matter of comparative strength as to which gives away first, the woodwork or the brickwork. Sometimes a combination is made of Figs. 52 and 53, but the benefits to be derived therefrom will have to be determined by the amount of insurance that has been placed upon the building at some previous time. Fig. 54 shows a common-sense way to finish around a chimney. It will be seen that the floor does not extend beyond the base line, and that the woodwork is in no way tied to or hung to the chimney. A perfect chimney should have a perfect foundation; but the *danger* that may result from an imperfect foundation can be almost, if not entirely, avoided by having the chimney plumb from bottom to top, and be entirely free from anything that will in any way interfere with its uniform settlement, provided that it will settle to a greater extent than the outside walls of the building. A "bracket chimney" can be made safe, but not by the somewhat usual method of having it supported by a double, or perhaps single joist that may have already been overloaded by the partition itself, and then hanging the chimney to the floor or roof above. For instance, a two-story cottage of ordinary size, and having a half-pitch roof, will require at least 26 ft. of chimney, provided that it starts from the first floor, taking an 8 x 12 in. flue for example, and you will have about 4,400 lbs. of brickwork resting upon a base about 16 x 20 ins., *or a load of more than 1,900 lbs. per square foot*, and in a majority of cases there will be no direct support for this weight below the first floor. Add to this fact the usual settlement and shrinkage, then add a case of Figs. 48, 49, 50, 51, 52, or 53, and the result is very liable to be a case of "defective flue."

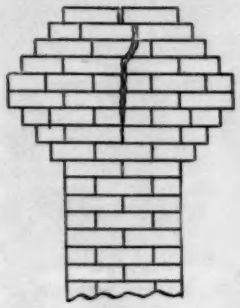


FIG. 47.

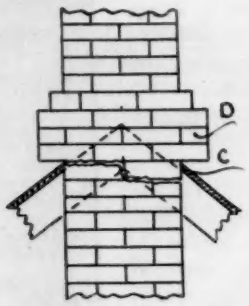


FIG. 48.

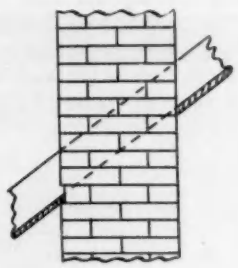


FIG. 49.

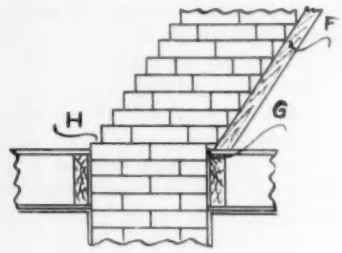


FIG. 50.

The only reliable way to prevent the almost inevitable crack between the woodwork and brickwork of a bracket chimney is to use a wrought-iron bracket covered with wire or metal lathing. The mason is not always to blame for defective flues: the carpenter is more often to blame than he, and the owner is very frequently more to blame than either of them. Some of the above examples might appear to be somewhat overdrawn, but it is nevertheless a fact that all of them, and more, too, can be found in nearly all towns and cities that have no ordinances or building laws to prevent them, and it is also true that the proper authorities of many towns and cities of considerable size cannot be prevailed upon to pass such laws, though for what reason it would be a hard matter to determine; such laws would not by any means increase the rates of insurance, nor would it increase the expenses of the fire department; it would not be any additional expense to the owner; neither would it be of any particular disadvantage to the reputable contractor, and it is not likely that the architect would have any serious objection to such laws, but there are people who will persistently fight against "safe construction" of any kind, and, therefore, the defective flue *must stay*.

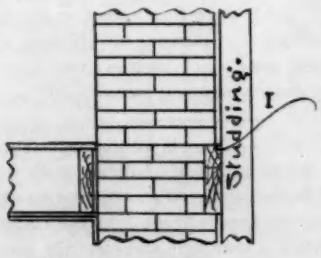


FIG. 51.

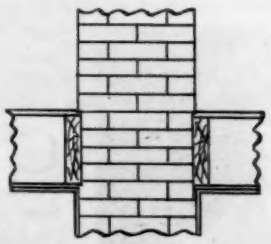


FIG. 52.

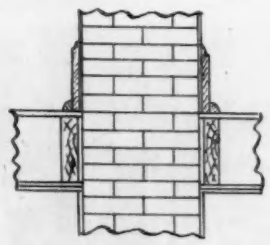


FIG. 53.

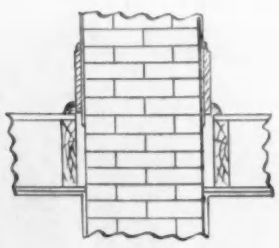


FIG. 54.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

NEW YORK.—It is the day of big things in buildings in New York. Statisticians report an enormous amount of building, in dollars and cents, during the past year. Yet it is patent that this has been expended upon a few large buildings, not upon the ordinary four or five story houses, and stables, and factories, and stores and tenements. Some of this sort of work of course goes on all the time, but the great bulk in value is attributable to the over-topping office buildings, the ten, twelve, and fourteen storied mercantile buildings, all of the new type of brick or stone encased iron frame construction.

The biggest thing of this sort just now going on is the new dry goods store, or, more properly, department store, for Siegel, Cooper & Co., DeLemos & Cordes, architects, at the corner of Sixth Avenue and 18th Street, extending along the block frontage two hundred feet to 19th Street, and covering three or four hundred feet in depth of the block.

It is now up to the fourth tier, built of white, or light cream-colored brick, with the usual incidents of marble-columned entrance porticoes, so far; and, no doubt, to blossom forth as it goes up with garlands and terra-cotta escutcheons, and cornices of terra-cotta, perhaps, more probably galvanized iron; for on so large a mass even a few cents per foot difference in cost makes many dollars difference in the whole. It is to have a rotunda internally and a tower externally,— rotunda and dome not coincident in plan, quite unrelated in fact.

It is only fair to abstain from criticism until it is done, but one may say that it promises not to present any harsh contrast in style with the large commercial buildings near, O'Neill's, Altman's, Macy's and the rest.

The Syndicate Building at Liberty Street and Nassau, a new tall office building, is about done externally. It stands opposite to the Mutual Life Company's building, high, but not so high, although the difference is of no great account from the street. A hundred or a hundred and fifty feet of perpendicular precipice, on each side of a rift called a street, about thirty feet wide from building line to building line, is sufficiently imposing and not more disproportionate than a six-foot street in Constantinople with its thirty or forty foot flanking houses. One distinct advantage there is in narrow streets,— they are cool in summer and warm in winter; in fact these might count as two distinct advantages.

The building law is again in process of revision by a large and competent committee, comprising many sub-committees. The only difficulty thus far met is that committeemen will not come to meetings. This causes some embarrassment, but doubtless, they who are running things know what they are about, and will see that a new measure is approved by the committee at the proper time.

It is reported that the revised law will require crossbridging to be nailed at each nailing with three twelvepenny nails instead of two tenpenny, and will include other tuppeny clauses to render building more secure, and to recruit the ranks of the reform office-holders.

A COLONIAL RESIDENCE, BUFFALO, N. Y.
Boughton & Johnson, Architects.

The Architectural League Exhibition opened on the fifteenth of this month, and is to be free, except on certain days, depending for income, we presume, on sales of catalogues, which are every year larger, and on the concomitant and lucrative ads.

TERRA-COTTA DETAIL OVER ENTRANCE OF THE FISHER BUILDING, CHICAGO.
D. H. Burnham & Co., Architects. Executed by The Northwestern Terra-Cotta Company.

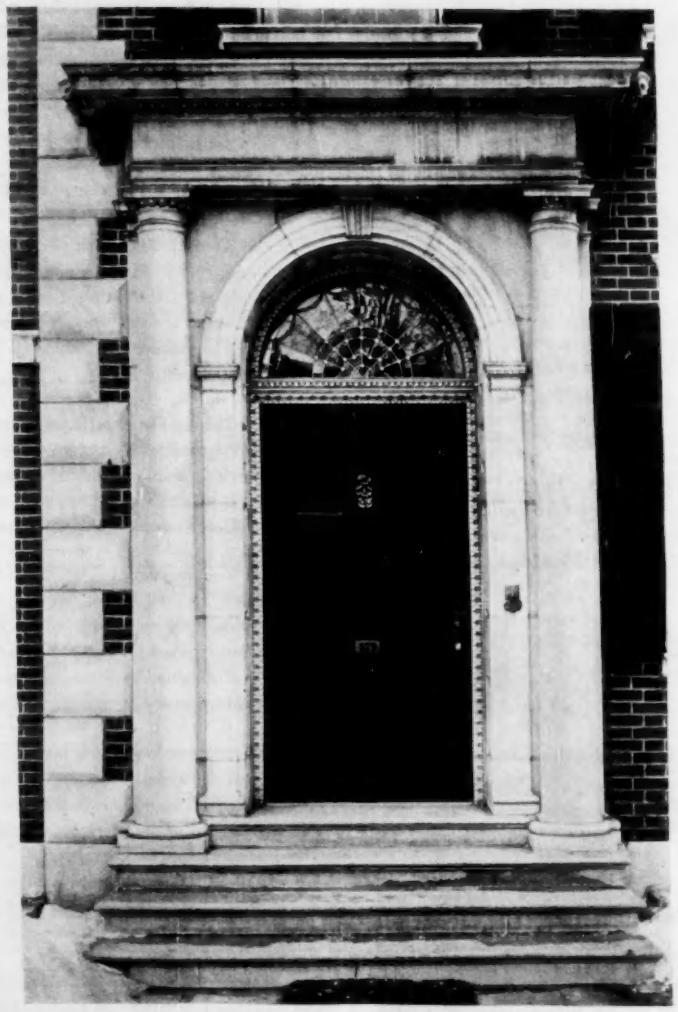
CHICAGO.— There is nothing sensational to record of Chicago building news this month. The statistician tells us that his figures show a decided improvement over the corresponding month a year ago, and certainly, prospects for spring building seem good. As some architects express it, "We are making a good many sketches." Aside from the usual list of minor structures and the mass of apartment buildings, there are quite a number of large possibilities talked of. One project, for a large office building in the "down town" district, on the site of the Grand Pacific Hotel, is postponed for a time. This is one result of the fact that the supply of offices is at present quite complete, and it serves as a check on new

schemes. But the fact that a new city ordinance has just raised the limit of height from 130 to 155 ft., is certainly having an encouraging influence. The old ordinances limited fire-proof construction to 130 ft., and allowed combustible construction 100 ft. high. This did not put a premium on fire-proofing methods. Instead of decreasing the combustible limit to 80 ft., as desired by the local chapter of the Institute of Architects, the other limit was raised to 155 ft. Several new office buildings, which seemed to have been waiting for the new ordinance, are now talked of. The new Davies Building, which has been mentioned previously in this column, will have three additional stories at once.

Speaking of colors: the white terra-cotta and buff brick of "The Old Colony Building," and the full glazed cream-white terra-cotta "Reliance Building," are being followed by quite a train of light color. The new "Great Northern" office building and theater is beginning to show an exterior of terra-cotta as nearly a dead white as could be obtained, and in detail the design is Gothic, following the Fisher Building which had the same architects. The Fisher Building, however, is yellow in color. The office building on Washington Street, which will be ready soon for its roof, has a front of white terra-cotta, each block of which has the appearance of having been carefully dabbed with a small brush of pale brown paint. The artificial appearance may be softened by the Chicago atmosphere, and have a very agreeable effect. A polychromatic experiment was tried for this same building, but not being deemed successful, two or three stories of terra-cotta went to the waste heap.

The future is to be dreaded, which may see some awful combinations of colors on buildings instead of the waste heap.

The next acquisition in the campus of the University of Chicago will be to accommodate the biological department. Four buildings connected by peristyle (so Mr. Cobb's preliminary sketches say) will surround a court beautified with lakes, fountains, and flower gardens. The uniformity in design of the present fine group of buildings will be continued.



ENTRANCE TO COLONIAL RESIDENCE, BUFFALO, N. Y.
Boughton & Johnson, Architects.

PITTSBURG. — Last year was an "off year" in the building line in this city; the number of buildings erected was 215 less than in the previous year; although fewer in numbers, there were 183 more of brick than in 1894; that is, brick as against frame, saying nothing of those of steel and terra-cotta. The quality was better, and therein may be seen the faith which the owners and architects have in the future of this city.

Pittsburg is somewhat behind in having many large office buildings; although several have been built in the past year or two, and others are at present under way, they are all built on a substantial basis. Among the best of these may be mentioned the Carnegie, Conestoga, Tradesman, and Park Buildings; the last two are not yet quite finished.

Architect F. E. Rutan has prepared plans for a handsome apartment house to be erected on Penn Avenue, and to be known as the "Bachelors' Apartment House." Architect Jos. Stillberg will prepare plans for an auditorium to be added to the Exposition Building to cost about $25,000. Architect F. J. Osterling will prepare plans for a handsome brick residence for T. D. Armstrong, the cork manufacturer, to cost about $20,000. Architects Longfellow, Alden, and Harlow have prepared plans for a $50,000 mansion for Capt. J. J. Vandergrift, to be erected on Fifth and South Highland Avenues. It will be of the French Renaissance style, 75 by 90, built of Pompeian brick and stone with ornamentation of terra-cotta work. The steel structure of the fifteen-story Park office building is about finished and the filling in of the brick and stone work is going on at a rapid gait; the fire-proofing of this building is being done by the Pittsburg Terra-Cotta Lumber Company.

MINNEAPOLIS. — Our dull season is now a thing of the past, and there is abundant reason for expecting the best building season we have experienced for several years. It is probable that a great deal of heavy work will be undertaken which will make a much larger showing for the year 1896. Rumors are rife as to the intentions of property owners, which give us the right to figure on some rather large building operations this year.

Among the larger undertakings already decided upon are the following: —

F. A. Clarke, architect, has planned a flat building for Mr. Mann, of Boston, Mass., 135 by 140 ft., three stories and basement, pressed brick, to contain twenty-nine apartments, cost estimated at $75,000. Same architect has planned a two-story flat building 55 by 200 ft., containing twenty apartments, to be faced with pressed brick and to cost $30,000.

Wm. Deering, of Chicago, will build a five-story business building at corner of 4th Street and Second Avenue, south, 90 by 110 ft., St. Louis pressed brick, slow-burning construction, at an estimated cost of $150,000.

Long & Kees have made plans for a warehouse 60 by 160 ft., six-story, mill construction, pressed brick fronts, to cost $40,000. Same architects have also planned a hotel building 50 by 152 ft., four-story, to build on 7th Street between Nicollet and Hennepin Avenues, with pressed brick fronts, to cost $35,000; business block at 5th Street and Second Avenue, south, 88 by 132 ft., three-story,

cost $20,000; warehouse building 97 by 158 ft., two stories and basement, mill construction, pressed brick front, cost $50,000.

W. S. Hunt has planned a church for Northeast Minneapolis, 72 by 88 ft., pressed brick fronts, to cost $8,000.

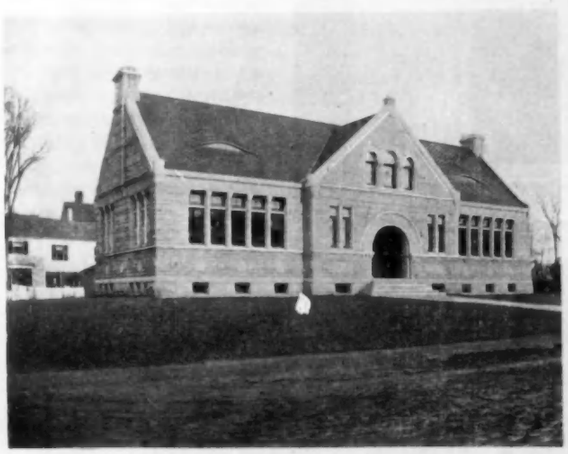
MARVELOUS STRENGTH OF A FIRE-PROOF FLOOR.

IN the Boys' High School of Philadelphia, the fire-proofing is being done by the Fawcett Ventilated Fire-proof Building Company, Limited, of the same city.

The first floor is constructed of 6 in. steel "I" beams, 13 lbs. per foot. The spans were 18 ft. long, and the beams are set 2 ft. centers. The terra-cotta lintels had been set in place and concreted over top of the same, up to the level of the top of the beams. This part of the work had been done for over two months. A few nights ago, during a heavy gale, a boom of one of the derricks became loose and swung around, and knocked down a line of columns and girders in the course of erection on the fourth floor. One of the cast iron columns struck a girder and broke in two. A portion of this column, weighing 432 lbs., fell to the first floor, a distance of 32 ft., striking the Fawcett floors endways, directly between the floor beams, and nearly in the center of the span, breaking a hole in the floor less than 3 ins. in diameter. The column fell over on the floor without further damage. It is estimated that the column struck the floor a blow of 13,888 ft. lbs., without further damage to the floor than the 3-in. hole referred to.

By looking back over the record of tests made by Mr. Geo. Hill, civil engineer of the various methods of fire-proofing, and recently published in THE BRICKBUILDER, one will more fully appreciate the wonderful strength of the Fawcett System of Fire-proofing, which is fully illustrated on page x of this issue.

THE accompanying cut illustrates the new Lithgow Library building at Augusta, Me. It is built of the best quality of Maine granite, and is roofed with dark red vitrified tile of the patent closed-shingle pattern, manufactured by Charles T. Harris, lessee of the



Celadon Terra-Cotta Company, Ltd., of Alfred, N. Y., whose product has been used on many of the finest buildings in New England.

The contrast between the granite walls and tile roof is strikingly beautiful, and yet in perfect harmony with the general style and artistic character of the building, which was designed by architects Neal & Hopkins of Pittsburg, Penn.

The general architecture is of the Romanesque-Renaissance school. The outside of the structure may be alluded to as quarry-faced ashler with line trimmings. The chimneys, instead of being deformities, are truly ornamental.

The names of authors famous in the world's annals are carved in the panels and medallions on the exterior of the building.

Entrance to the building is under a beautiful Roman arch supported by massive pillars. The rotunda is supported by eight Ionic fluted columns.

At the left of the entrance is the book room, which has twelve steel memorial alcoves, each holding from twelve hundred to fourteen hundred volumes.

In the advertisement of the Celadon Company, on page xvi, we illustrate another New England library just finished, the roof of which is covered by Conosera Red Tile.

SEMI-OCCASIONALLY some prominent architect will, unsolicited, indorse the position taken by THE BRICKBUILDER, that examples of the higher ideals of the trades it represents are not wanting in these days of haphazard methods. We are glad to print the following letter, which needs no further comment: —

E. A. KENT, ARCHITECT,
WHITE BUILDING.

BUFFALO, N. Y., Jan. 28, 1896.

NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY,
38 PARK ROW, NEW YORK.

Gentlemen: The work you did for the Chapin Building here is so thoroughly well modeled, colored, and burnt that I want to send you an unsolicited testimonial, if such a thing is of value, and to say that it is not only the best work I have had done, but the best work I have seen anywhere. Very truly yours,

(Signed) E. A. KENT.

THE Tiffany Pressed Brick Company, Chicago, has issued a neat little booklet which gives the sizes, colors, cost, etc., of their make of enameled brick. Added to this are indorsements from leading architects, of their product, with a list of some of the more prominent buildings where "Tiffany" enameled brick has been used.

THE Reconstructed Granite Company, Wm. Courtenay, president, office, 14 Dey Street, New York, is looking for a site in or near New York City on which to build a factory for the manufacture of "Reconstructed Granite" for architectural and ornamental uses.

Mr. Courtenay is desirous of securing a brick or terra-cotta plant that could be easily converted to the requirements of his company.

THE new catalogue just issued by the Boston Fire-Proofing Company is a credit to both this company and its printer. It is printed in pocket size, and contains several finely finished half-tone illustrations of many of Boston's most representative buildings which this company has fire-proofed.

It is comprehensive and concise, and deals with the subject very thoroughly. Its analysis is liberal, and augmentatively, as has terra-cotta, practically demonstrated the excellency of this material for fire-proofing.

It contains an article on concrete that is novel and thorough, defining the relative heat and conductive properties of concrete and terra-cotta; the reasons for many difficulties encountered in the use of concrete for floors; also a summary of the Denver Tests, so commonly referred to in matters of fire-proofing; extracts of the building laws as exacted by the city of Boston on fire-proofing matters; tables of the strength of steel beams, channels, and columns; strength of arches; also the United States Government test on the strength of porous terra-cotta; a most useful table to buyers, on the expense of the transportation of any article of fire-proofing to any point, and at any rate of freight.

It also contains a complete stock schedule of all the kinds, sizes, and weights of goods manufactured by this company, that is very useful to architects in laying out their iron work.

We take pleasure in calling attention of architects, builders, and owners to this catalogue, and believe they can find many answers to questions long in dispute, and a great deal of information.

It will be mailed free, by request to the Boston Fire-Proofing Company, Master Builders' Exchange, 166 Devonshire Street, Boston, Mass.

THE CUTLER MANUFACTURING COMPANY, of Rochester, N. Y., makers of the United States Mail Chute, now a familiar feature in the equipment of first-class hotels and office buildings, have secured a series of Mr. Claude Fayette Bragdon's admirable pen and ink sketches of minor Italian palaces, made on the spot in the summer of 1895 and not before published. The sketches will be issued quarterly, in four portfolios, each containing six plates, and will be sent to architects who are or have been in correspondence with the firm regarding their specialty. Architects should be familiar with the simple but somewhat exacting requirements which are a prerequisite to the installation of the Cutler Patent Mailing System, and a statement of them, with detail drawings and specifications of preparatory work, and estimates of cost, etc., will be promptly forwarded by the manufacturers, on request.

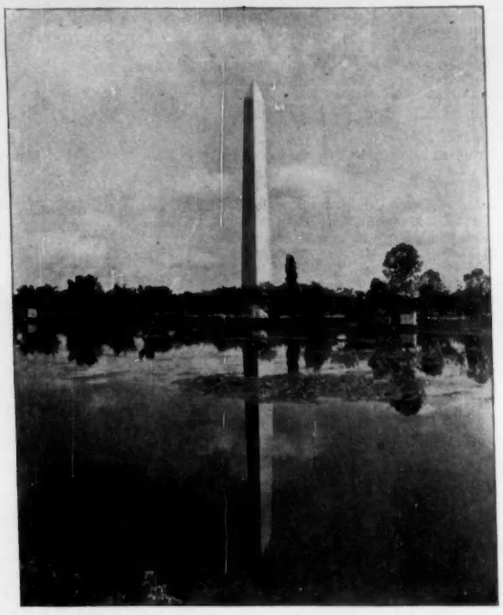
FOR two years it has been known that the Illinois Railroad was to build a subway to contain their tracks, extending from their depot to a distance of one and one half miles along the lake front, running parallel with Michigan Avenue, fronting on which are some of Chicago's finest hotels and public buildings.

It has been decided to construct this subway of concrete instead of granite masonry, and the contract for the cement has been awarded to the Alpha Portland Cement Company. Some forty thousand or fifty thousand barrels of cement will be used for this work during 1896.

This piece of work will start concrete construction in the West, and will be followed with much interest by engineers throughout the country.

IMAGINE what improvements in the art of brickmaking have taken place within the last few years! The Kulage Machine Works, St. Louis, Mo., state that with their machinery, the finest and best pressed front bricks can be put into the kiln ready for the fire at a total cost of less than one dollar per thousand bricks.

WASHINGTON MONUMENT.



As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

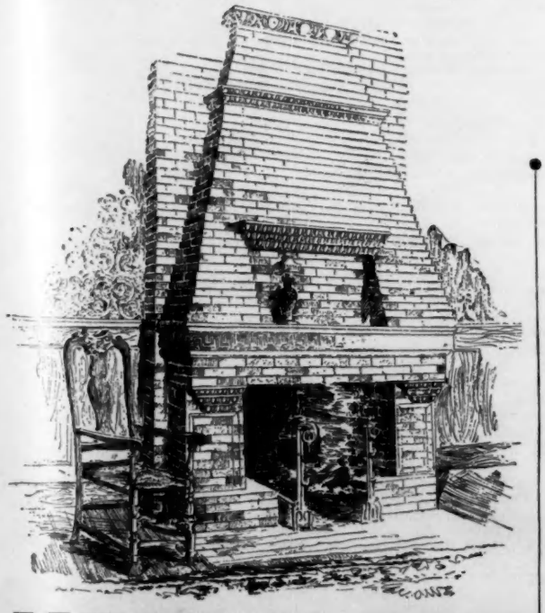
The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,

College Avenue, St. Louis, Mo.

We construct and equip brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine — a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, COLLEGE AVE., ST. LOUIS, MO.



HERE IS ONE

Representation of a **FIREPLACE MANTEL.** Our Sketch Book, containing 39 others, will be sent you on application.

JUST THE THING

FIREPLACE MANTELS MADE OF MOULDED BRICK

In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

PHILA. & BOSTON FACE BRICK CO.,

No. 4 LIBERTY SQUARE, BOSTON, MASS.

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